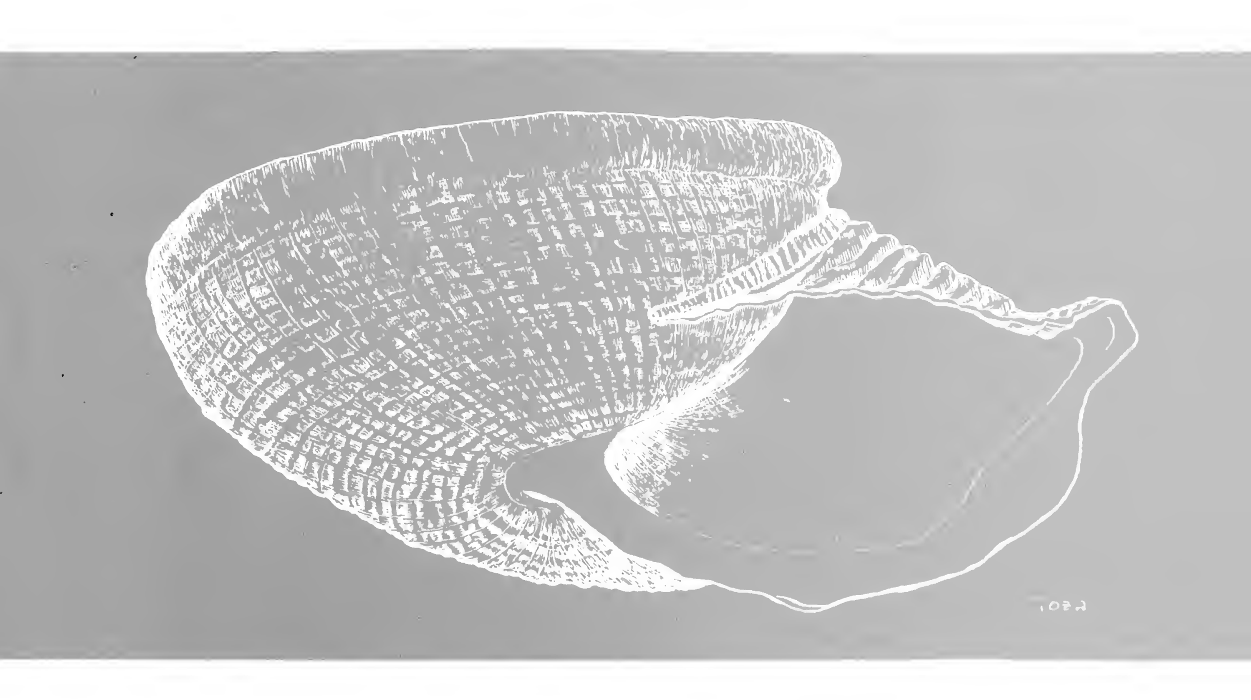
Iberus

Vol. 32 (1)

REVISTA DE LA SOCIEDAD ESPAÑOLA DE MALACOLOGÍA



Oviedo, enero 2014

Iberus

Revista de la

SOCIEDAD ESPAÑOLA DE MALACOLOGÍA

PORTADA DE *Iberus*

Iberus gualtieranus (Linnaeus, 1758), una especie emblemática de la península Ibérica, que da nombre a la revista. Dibujo realizado por José Luis González Rebollar "Toza".

Iberus



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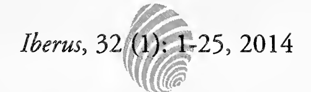
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New information on the marginellids of São Tomé and Principe, with new records and the description of four new species

Nueva información sobre los marginelidos de São Tomé y Principe, con nuevas citas y descripción de cuatro especies nuevas

Emilio ROLÁN* & Sandro GORI**

Recibido el 5-XII-2012. Aceptado el 28-X-2013

ABSTRACT

Some marginellids collected in the islands of the Guinean Gulf, São Tomé and Principe, are studied, presenting new records, descriptions and figures of uncommon forms and complementary information. Four new species are described.

RESUMEN

Se estudian algunos marginélidos recolectados en las Islas del Golfo de Guinea, São Tomé y Príncipe, y se presentan nuevas citas, descripciones y figuras de formas no habituales, e información suplementaria. Se describen cuatro especies nuevas.

INTRODUCTION

The marginellids from the islands of the Guinean Gulf have been studied for many years. TOMLIN & SHACKLEFORD (1912, 1913a & 1913b) mentioned from São Tomé 13 species names from this group, but many of them, such as *Marginella miliaria* (Linnaeus, 1758), *M. bifasciata* Lamarck, 1822 and *M. olivaeformis* Kiener, 1834, belong to other geographical areas and were not correctly identified. These authors described four new species: *Marginella eveleighi, M. liparozona, M. melvilli* and *M. chalmersi*. NOBRE (1886, 1887) also recorded some species from these islands.

In more recent papers, GOFAS & FERNANDES (1988) presented a revision of the family in the island of São Tomé, describing 11 species, of which 7 were new. Later, FERNANDES & ROLÁN (1992) provided new records for both São Tomé and Principe islands and described a new species. Since these two papers and for many years, no new publications were issued on the Marginellidae of these islands.

During recent years, the second author (SG) visited several times these islands, with many dives resulting in the collection of a large amount of samples (see collecting points in Figure 1 and Table I); the Marginellids were set aside in order to make a complete revision of the group but unfortunately some material was made available elsewhere so that COSSIGNANI (2012) described three new species on the basis of only nine shells and with scarce information, and furthermore made some mistakes that will be discussed in the present work.

The study of several hundred specimens and shells of Marginellidae is the

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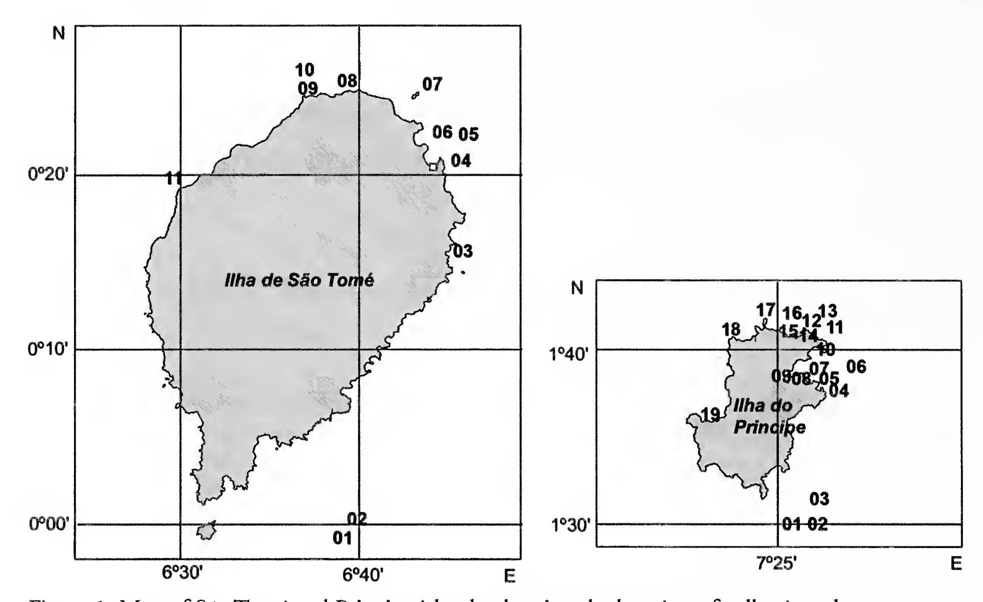


Figure 1. Map of São Tomé and Principe islands, showing the location of collecting places.
Figura 1. Mapa de las islas de São Tomé y Principe, indicando la situación de los puntos de muestreo.

basis for the present work in which some new records are made and 4 new species are described.

MATERIAL AND METHODS

Most of the shells were collected by scuba diving, in some cases at night. Some places were visited and sampled many times in nearly identical locations. In some cases positions were recorded with a portable GPS.

Abbreviations

MMM Malacologia Mostra Mondiale, Cupra Maritima, Italy
MHNG Museum d'Histoire Naturelle, Geneva, Switzerland
MHNS Museo de Historia Natural, Santiago de Compostela, Spain
MNCN Museo Nacional de Ciencias Naturales, Madrid, Spain
MNHN Muséum National d'Histoire Naturelle, Paris, France
NMW National Museum of Wales, Cardiff, Wales
CCS collection of Cedric Simbille, Paris, France
CFB collection of Franck Boyer, Paris, France
CFD collection of Francisco Déniz Guerra, Canary Is., Spain
CJR collection of José Rosado, Maputo, Moçambique
CPR collection of Peter Ryall, Maria Rain, Austria
CSG collection of Sandro Gori, Livorno, Italy

RESULTS

Genus *Plesiocystiscus* Coovert & Coovert, 1995
Plesiocystiscus violaceus spec. nov. (Figure 2A-H)

Type material: Holotype in MNHN (26621H, sp, Fig. 2A) and 2 paratypes in MNHN (26621P, sp in alcohol). Other paratypes: MNCN 15.05/60085, 1 sp), CSG (2 sp); CPR (1 sp) and CJR (1 sp).

Table I. Coordinates of sampling places. Only the place name is given where a GPS was not used.
Tabla I. Coordenadas de los lugares de muestreo. Solamente se da el topónimo cuando no se usó un GPS.

Numbers in map	São Tomé		
01	Sete Pedras	00°01.600′ N	06°37.600′ E
02	Pedra Branca	00° 02.091′ N	06° 37.588′ E
03	Ilheu Santana	00° 14.660′ N	06° 45.039′ E
04	São Tomé city	00°20′ 10″	N 06°40′ 53″ E
05	Minerio	00° 23.016′ N	006° 46.228′ E
06	Baia Ana Chaves		
07	Kia Reef		
08	Pedra Conchas		
09	Lagoa Azul-Morro Carregado		
10	Lagoa Azul Fundao	00° 24.492′ N	06° 36.431′ E
11	Ponta de Diogo Vaz	00° 19.159′ N	06° 29.633′ E
12	Esprainha		
	Principe		
01	Tinhosa Pequena	01° 22.521-900′ N	07° 16.535-984′ E
02	Tinhosa Grande	01° 20.334-627′ N	07° 17.354-698′ E
03	Ilheu Boné de Joquei	01° 30′ 640-921′ N	07° 25′ 45-962′ E
04	Ponta da Graça	01° 38′ 20″N	07° 28′ 28″E
		01° 37.497′ N	01° 27.404′ E
		01° 36.959′ N	07° 27.269′ E
05	Ponta Viro Viro	01° 38.406′ N	07° 27.329′ E
06	Sete Brazas	01° 37.751′ N	07° 28.984′ E
		01° 37.798′ N	07° 29.019′ E
		01° 39.126′ N	07° 28.127′ E
07	Ponta Cabra	01° 38.442-460′ N	07° 27.208-283′ E
08	Ponta da Mina	01° 38.438-974′ N	07° 26.218-607′ E
09	Chimado-Hospital Velho	01° 38.802′ N	07° 25.737′ E
10	Ilheu Santana	01° 39.684′ N	07° 22.820′ E
11	Ilheu dos Mosteiros	01° 41.129-231′ N	07° 27.337-360′ E
12	Pedra do Kaki	01° 40.489′ N	07° 27.564′ E
13	Pedra Galé	01° 43.419-533′ N	07° 22.765-849′ E
	Praia Evora	01° 38.24-727′ N	07° 26.34-540′ E
14	Praia Campana		
15	Ponta das Burras		
16	Praia das Burras		
17	Ilheu Bom Bom		
18	Ponta Marmita	01° 40.951′ N	07° 22.140′ E
19	Baia das Agulhas	01° 36. 484′ N	7° 20. 222′ E

Type locality: Sete Pedras, SE of São Tomé Island.
Etymology: The specific name alludes to the violet colour of the soft parts.

Description: Shell small, shiny and translucent, oblong, swollen posteriorly, with a low and very globose spire. Outer lip thickened and curved, internally smooth. Columella with four weak plaits, aperture narrow and elongate, wider on the anterior part.

Soft parts: Described from the examined material after being fixed, but it was recorded that this colour pattern was

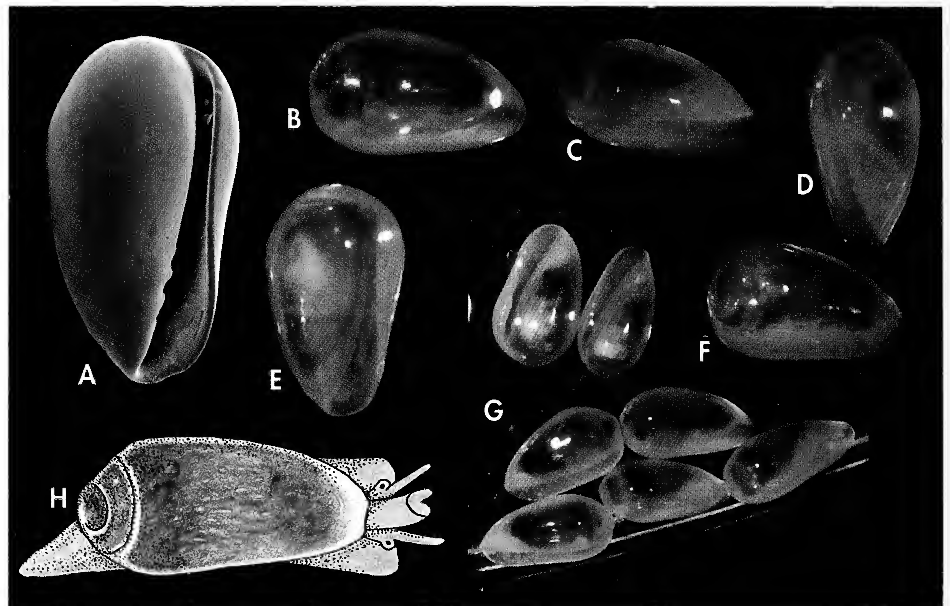


Figure 2. *Plesiocystiscus violaceus* spec. nov. A: holotype, 2.6 mm (MNHN); B-F: paratypes, with soft parts; G: group of paratypes in alcohol; H: colour pattern.
Figura 2. Plesiocystiscus violaceus *spec. nov. A: holotipo, 2,6 mm (MNHN); B-F: paratipos, con partes blandas; G: grupo de paratipos en alcohol; H: patrón de color.*

similar when alive: Animal with a red-violet colour, on all the body parts visible by transparency. It is a little darker in the anterior and posterior parts comprised within the shell; there are some small oval lighter spots, not very numerous; the visible parts of head, siphon and foot are whitish with purple dots.

Dimensions: Holotype 2.6 mm. Paratypes of similar size.

Habitat: Collected brushing spheroid concretions of a coralline alga in 27-30 m depth. These concretions are frequent on the bottom surrounding the islands of the Guinean gulf.

Distribution: Only known from type locality.

Remarks: The differences with other described species from that area are seen in the soft parts, the shell being very similar:

- *Plesiocystiscus gutta* (Gofas & Fernandes, 1988) is very dark in colour, visible by transparency, with numerous yellowish microspots and a few red ones; the foot is whitish with some brown spots on the anterior part, including the head, and yellow on the caudal part.

- *Plesiocystiscus josephinae* (Fernandes & Rolán, 1992) was collected in Principe Island and it has, visible by transparency within the shell, very dark parts anteriorly and posteriorly, with a wider space between them which is pink with small orange spots. The foot is whitish-translucent and only the propodium is orange.

Genus *Volvarina* Hinds, 1844
Volvarina insulana Gofas & Fernandes, 1988 (Figure 3A-E)

Volvarina insulana Gofas & Fernandes, 1988: 13, figs. 14-15, pl. 1D. [Type locality: Esprainha].

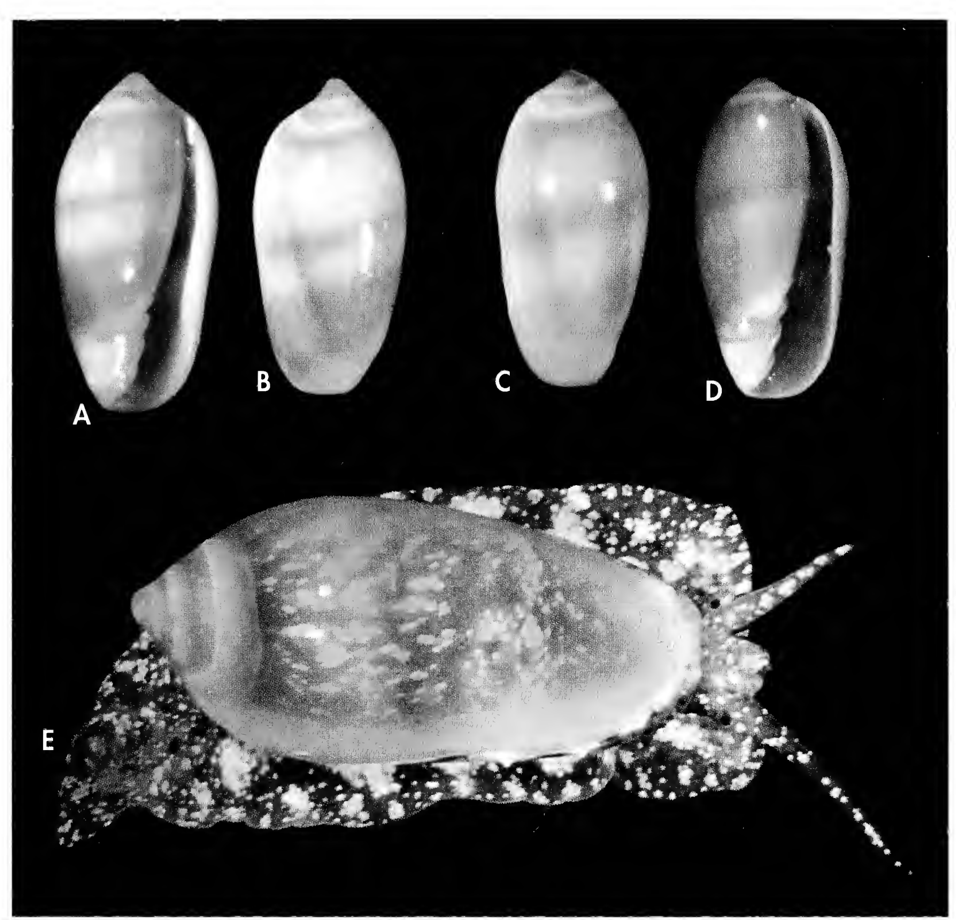


Figure 3. *Volvarina insulana* Gofas & Fernandes, 1988; A-D: shells, 8.9, 8.1, 8.4, 8.2 mm, Tinhosa Grande, 15 m, Principe Island (CSG); E: living animal on a dark background.
Figura 3. Volvarina insulana *Gofas & Fernandes, 1988; A-D: conchas, 8,9; 8,1; 8,4; 8,2 mm, Tinhosa Grande, 15 m, isla del Principe (CSG); E: animal vivo sobre fondo oscuro.*

Type material: Holotype in MNHN (represented in GOFAS & FERNANDES, 1988, fig. 14a, 14b).
Other material examined: Principe Island: 7 s, Pedra Galé, 10-35 m (CSG); 1 s, Tinhosa Pequena, 41 m (CSG); 5 s, Sete Brazas, 21 m (CSG); 5 s, Sete Brazas, 20 m (CSG); 5 s, Tinhosa Grande, 15 m(CSG); 2 sp, Ponta Cabra, Baia de Santo Antonio, 10 m (CSG); 2 s, Tinhosa Pequena West, 42 m (CSG); 1 s, Ponta da Mina, 10 m (CSG); 1 s, Ilheu Santana, Baia de Santo Antonio, 10 m (CSG); 1 sp, Baia das Agulhas, 10 m (CSG). São Tomé Island: 2 s, Ilheu Santana, 21 m (CSG); 35 s, Esprainha, 2-10 m (MHNS).

Description: See GOFAS & FERNANDES (1988). The soft parts from specimens of Principe have a transparent foot with milk-white blotches (Fig. 3E).

Distribution: São Tomé and Principe Is.

Remarks: The radula of this species was presented in FERNANDES & ROLÁN (1992: fig. 1A). This species was described as having a shell with three fading darker bands. In the material from Principe, these bands are more marked (Figs. 3A-D). Some shells were totally cream without bands.

Genus *Marginella* Lamarck, 1799

Marginella helmatina Rang, 1832 (Figure 4A-I)

Marginella helmatina Rang, 1832: [Type locality: see Remarks: Principe Island?].

Type material: In MNHN (0530) a lot of 4 syntypes, one of which is represented on the institutional website <http://coldb.mnhn.fr>

Other material examined: Principe Island: 1 sp (Fig. 4), 1 s, 1 j, Ponta da Mina, (CSG); 3 sp, Ponta da Mina, 6 m, Santo Antonio (CCS, CJR); 1 s, Ponta Cabra (CSG); 2 s, Ponta Marmita, 13 m (CCS, CJR); 12 sp, Baia das Agulhas, 3-7 m (CSG). Gabon: 1 sp, Port Gentil, 20-25 m (CSG).

Description: See RANG (1832). The soft parts (dorsum of the foot, siphon and tentacles) are translucent with numerous milk-white and some orange spots.

Dimensions: Up to 26 mm.

Habitat: This species prefers calm water and sandy bottoms, between 3 and 13 m.

Distribution: This species is known from Principe Island and there are records from Gabon (Bernard, 1984) and from Senegal.

Remarks: RANG (1832) wrote after the description of this species: "*Nous avons trouvé la Marginelle helmatine sur la côte d'Afrique, depuis l'embouchure de la Gambie jusqu'aux Bisagots*". However the label of the MNHN specimen reads "Ile de Prince". In this situation we consider that the syntype represented would be more similar to the population here studied, whereas the material seen from Senegal: (http://www.femorale.com.br/shellphotos/detail.asp?species=Marginella+helmatina+Rang%2C+1832) is evidently rather different morphologically and it could be a different species, or a population with different characters (wider and thicker shell than the population from Principe). The shells of the population mentioned from Gabon (Bernard, 1984 and Fig. 4I) are also quite different and their relationship with the insular population is still to be studied.

Marginella gemma Adams, 1850 (Figures 5A-O, 6A-H)

Marginella gemma Adams, 1850. [Type locality: "East Africa"].

Marginella gorii Cossignani, 2012. *Malacologia Mostra Mondiale*, 75: 29. [Type locality: Principe Island].

Type material: Holotype of *Marginella gemma* Adams, 1850 in (NHMUK 1961135)(GOFAS & FERNANDES, 1988: fig. 31a, 31b); holotype of *Marginella gorii* in MMM (COSSIGNANI, 2012, figs. without number).

Other material examined: Principe I.: 5 sp, Tinhosa Grande, 15 m (CSG); 1 s, Ponta da Graça, 22 m, under rocks (CSG); 3 sp, 1 s, Ponta da Graça, 22 m (CSG); 1 sp, 1 s, Pedra Galé, 10 m (CSG); 13 sp, Pedra Galé, 35 m (CSG); 2 sp, Pedra Galé, 10 m (CSG); 3 sp, Ilheu dos Mosteiros,20 m (CSG); 1 sp, Tinhosa Grande, 15 m (CSG); 1 sp, 1 j, Tinhosa Grande, 12 m (CSG); 4 sp, 1 s, Tinhosa Grande, 15 m (CSG); 3 sp, Tinhosa Pequena, 42 m (CSG); 1 sp, Sete Brazas, 10 m (CSG); 12 sp, Sete Brazas, 26 m (CSG); 4 sp, 17 m (CSG); 2 sp, Pedra do Kaki, 16 m (CSG); 2 sp, Tinhosa Pequena, 25 m (CSG); 11 sp, 1 s, 2 j, Bonné de Joquei, 15 m (CSG); 2 sp, Ilheu Santana, Santo Antonio, 10 m (CSG).

Description: This is a very variable species in size and mainly in pattern colouration: In Figures 5A-O, we represent 15 specimens that are very different, and between these specimens there are intergradations so that they constitute forms of one single species.

Soft parts: the animal is almost transparent with very fine milk-white small spots everywhere (foot, siphon and tentacles) (Figs. 6G-H).

Dimensions: The holotype of *M. gemma* is 11.6 mm. The holotype of *M. gorii* is 11.25 mm. The larger shells col-

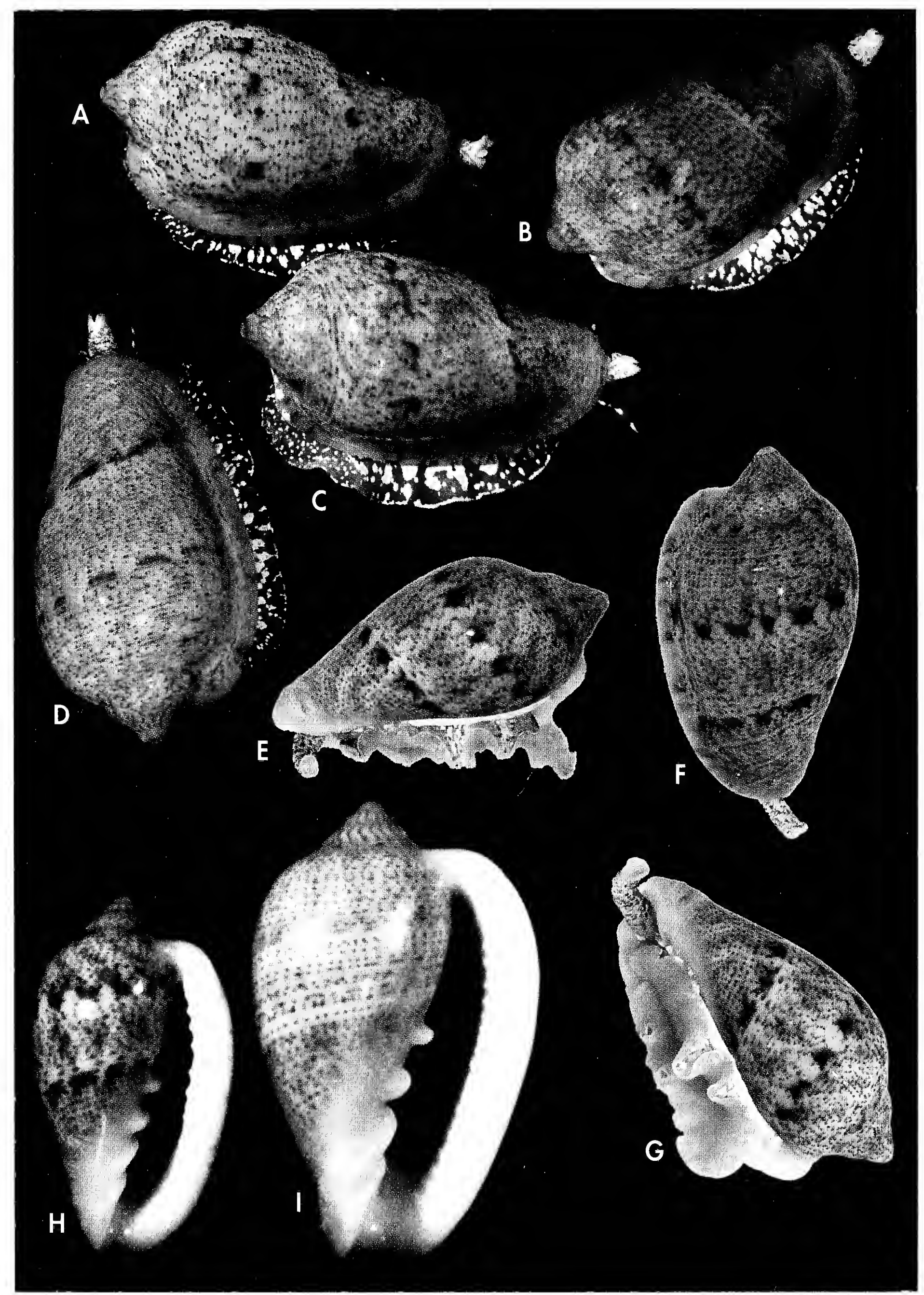


Figure 4. *Marginella helmatina* Rang, 1832. A-G: Living specimens on dark background, Ponta da Mina, Santo Antonio, Principe Is; H: shell, 19.2 mm, Ponta Cabra, Baia de San Antonio, 10 m (CSG); I: shell, 24.0 mm, Port Gentil, Gabon, 20-25 m (CSG).

Figura 4. Marginella helmatina *Rang, 1832. A-G: animales vivos sobre fondo oscuro, Ponta da Mina, Santo Antonio, Isla del Principe; H: concha, 19,2 mm, Ponta Cabra, Baia de San Antonio, 10 m (CSG); I: concha, 24,0 mm, Port Gentil, Gabon, 20-25 m (CSG)*

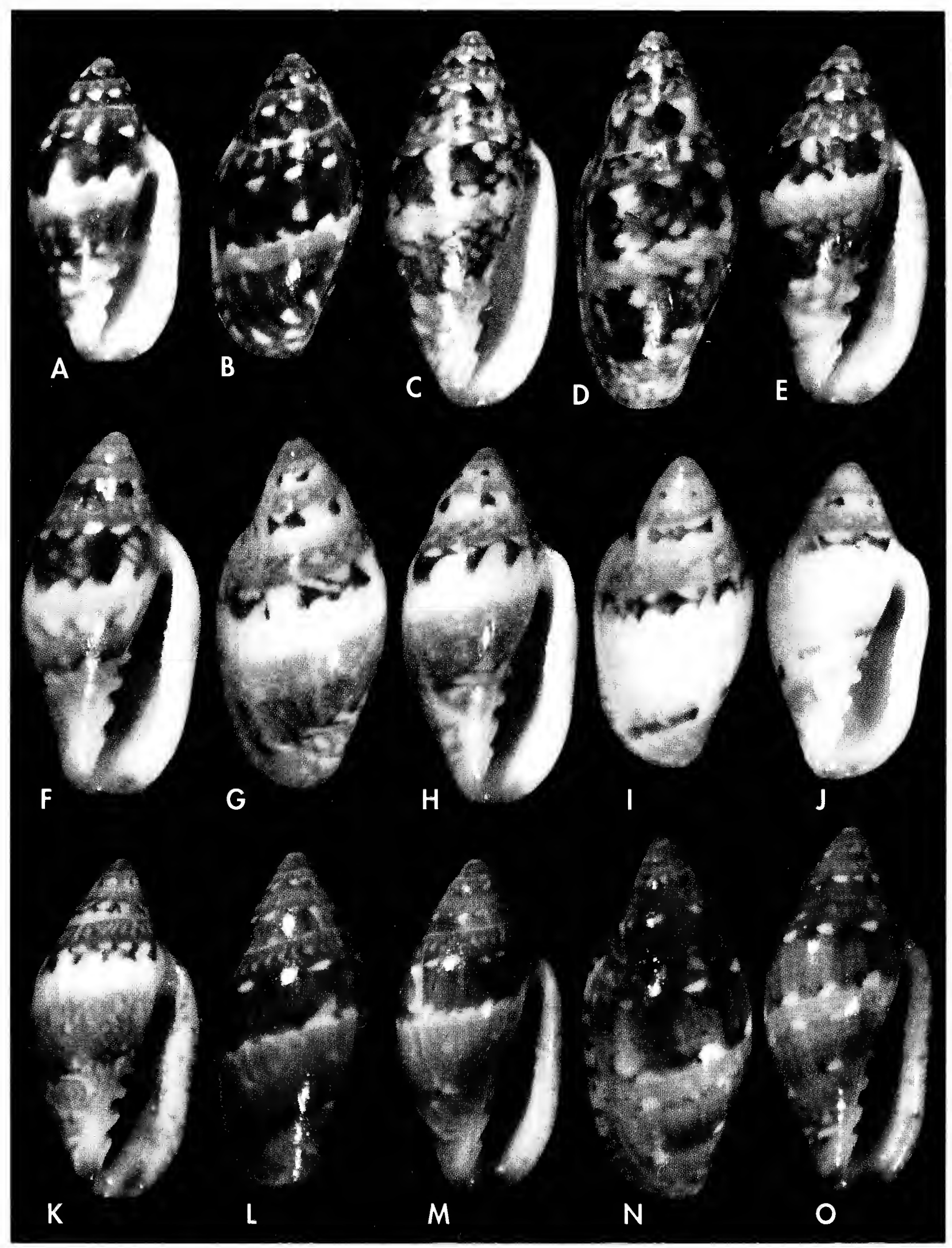


Figure 5 A-O. *Marginella gemma* Adams, 1850. A, B: shell, 11.3 mm, Pedra Galé, 10; C-E: shells, 14.3, 14.3, 13.4 mm, Tinhosa Grande, 15 m; F: shell, 12.5 mm, Pedra Galé, 35 m; G, H: shells, 12.2 and 13.3 mm, Mosteiros Fora, 20 m; I, J: shell, 11.6 mm, Tinhosa Grande, 15 m: K: 12.6 mm, Sete Brazas, 20 m; L-O: shells, 12.6, 12.6, 13.7, 13.7 mm, Pedra Galé; all from Principe island (CSG).

Figura 5 A-O. Marginella gemma *Adams, 1850. A, B: concha, 11,3 mm, Pedra Galé, 10; C-E: conchas, 14,3; 14,3; 13,4 mm, Tinhosa Grande, 15 m; F: concha, 12,5 mm, Pedra Galé, 35 m; G, H: conchas, 12,2 y 13,3 mm, Mosteiros Fora, 20 m; I, J: concha, 11,6 mm, Tinhosa Grande, 15 m: K: 12,6 mm, Sete Brazas, 20 m; L-O: conchas, 12,6; 12,6; 13,7; 13,7 mm, Pedra Galé; todas de isla del Principe (CSG).*

lected reach up to 14.5 mm, but some populations can have smaller shells.

Habitat and distribution: The species was collected only in Principe Island in many localities, under rocks, on rocky bottoms. We noted that the shells inside Baia de Santo Antonio (with calm water) are smaller and less colourful. The largest and more colourful specimens were found in the small islet outside the bay, where the water is rougher.

Remarks: GOFAS & FERNANDES (1988: fig. 31a, 31b) represented the holotype of *Marginella gemma* Adams, 1850 (in BMNH 1961135). These figures are rather similar to our Figure 5I-J, which represent a form with light colour but only a variation. The shell shown by FERNANDES & ROLÁN (1992, fig. 2) has a different pattern more similar to our Figure 5E.

COSSIGNANI (2012) described the species here studied as *Marginella gorii*, the holotype and paratypes being rather similar to our Figures 5L-O. This shows that an overview of the variability of a species is needed before describing a new one based on only a few specimens.

This species is larger than *M. spinacia* Gofas & Fernandes, 1988, and has a wider shell.

Marginella cf. *melvilli* Tomlin & Shackleford, 1913 (Figure 6I-M)

Marginella melvilli Tomlin & Shackleford, 1913: 11, pl. 1, figs 1-2. [Type locality: São Tomé island].
?*Marginella liparozona* Tomlin & Shackleford, 1913: 43. [Type locality: São Tomé island].

Type material: *M. melvilli*, holotype in NMW (1955-158-1094), represented in GOFAS & FERNANDES (1988: figs. 4a, 4b, 5a, 5b); *M. liparozona*, lectotype in NWM (1955-158-1093) (Fig. 6I), also represented in GOFAS & FERNANDES (1988: figs. 6a, 6b).
Other material examined: Principe: 10 sp, Ponta das Burras, 2-5 m (CSG); 1 s, Ponta Viro Viro, inside of the Baia de Santo Antonio, 01°38'406"N, 07°27'329"E, 16 m (CSG); 4 sp, Ilheu Bom Bom, 10 m (CSG).

Description: See TOMLIM & SHACKLEFORD (1913) and GOFAS & FERNANDES (1988).

Remarks: These taxa (*M. melvilli* and *M. liparozona*) are admitted by GOFAS & FERNANDES (1988) as possible synonyms because the difference of the pink bands is not important in this group.

The material collected and presented in this work has more colour and a more marked pattern than the holotype, but the latter could be from a light form (like *M. liparozona*). At present the status of these taxa awaits more information and provisionally we keep them as different from *M. gemma*.

Marginella chalmersi Tomlin & Shackleford, 1912 (Figure 7 A-K)

Marginella chalmersi Tomlin & Shackleford, 1912: 320, pl.4, figs 3-4. [Type locality: São Tomé].

Type material: Holotype (Figs. 7B-C) in NHMUK (7124).
Other material examined: São Tome: 12 sp, Sete Pedras, 10 m (CSG); 2 sp, Lagoa Azul-Morro Carregado, 12 m (CSG); 55 sp, Lagoa Azul "Fundão" at 15-36 m, collected during the night (CSG).

Description: See TOMLIN & SHACKLEFORD (1912) and GOFAS & FERNANDES (1988). The new population found is as follows: Shell ovoid elongate, robust, smooth and shiny, with a high spire and rounded apex. Suture indistinct. Aperture narrow and elongate, larger than 1/2 of the height size. Outer lip thickened, with about 10-14 denticles inside. The colouration is cream-white and dark brown: two bands of this last colour are visible on the last whorl: the upper one is larger, separated from the suture by a light band, and it is formed by two parts, the upper one



Figure 6. A-F: *Marginella gemma* Adams, 1850. A, B: shell with a similar shape to the holotype, 10.9 mm, Ponta das Burras, São Tomé (CSG). C, D: shells with a dubious pattern from Pedra Galé, 13.1 and 11.5 mm (CSG); E, F: shell with typical light pattern, 14.8 and 12.4 mm, Bonné de Joquei, Principe (CSG). G, H: live collected specimens, showing their soft parts. I-M: *Marginella* cf. *melvilli* Tomlin & Shackleford, 1913; I: lectotype of *M. liparozona*, 7.4 mm (NMW); J-M: shells considered as forms of *M. melvilli*, 11.0, 11.0, 11.1, 10.1 mm, Ilheu Bombom, Principe (CSG).

Figura 6 A-F: Marginella gemma *Adams, 1850. A, B: concha con forma similar al holotipo, 10,9 mm, Ponta das Burras, São Tomé (CSG). C, D: conchas con un patrón de color dudoso, de Pedra Galé, 13,1 y 11,5 mm (CSG); E, F: concha con patrón claro típico, 14,8 y 12,4 mm, Bonné de Joquei, Principe (CSG). G, H: ejemplares recolectados vivos, mostrando sus partes blandas. I-M:* Marginella *cf.* melvilli *Tomlin & Shackleford, 1913; I: lectotipo de* M. liparozona, *7,4 mm (NMW); J-M: conchas consideradas como formas de* M. melvilli, *11,0; 11,0; 11,1; 10,1 mm, Ilheu Bombom, Principe (CSG).*

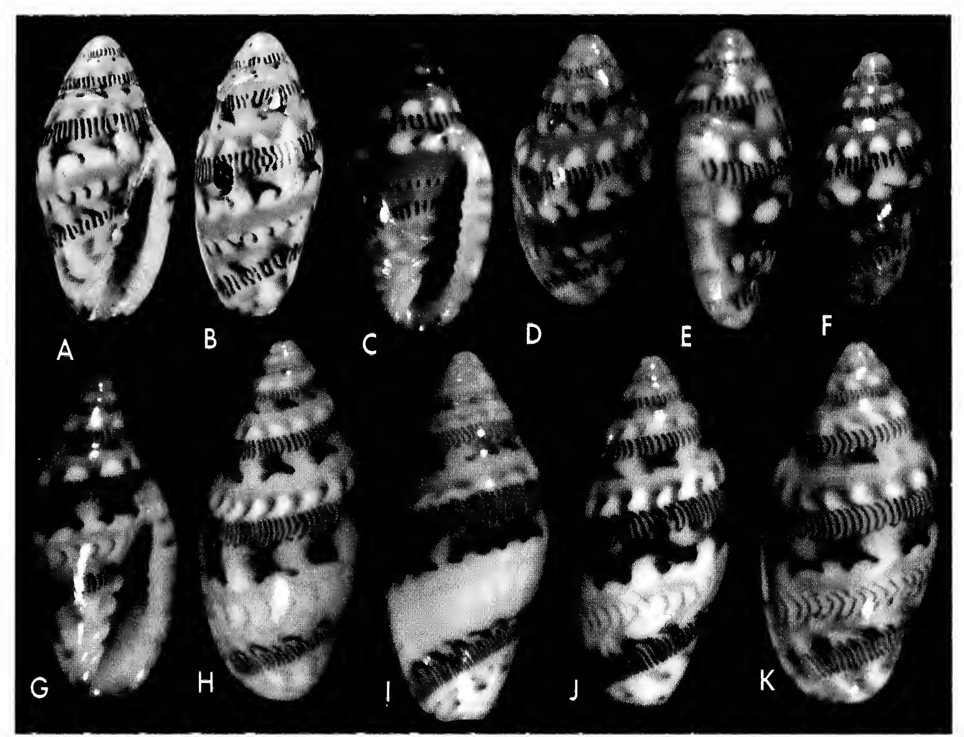


Figure 7. *Marginella chalmersi* Tomlin & Shackleford, 1912. A, B: holotype (NHMUK 7124); C-F: shells, 5.9, 5.5, 6.1, 5.1 mm, from Sete Pedras, São Tome, 10 m (CSG); G-K: shells 6.9, 7.8, 7.8, 7.5, 7.9 mm, Lagoa Azul "Fundão", São Tomé (CSG).
Figura 7. Marginella chalmersi *Tomlin & Shackleford, 1912. A, B: holotipo (NHMUK 7124); C-F: conchas, 5,9; 5,5; 6,1; 5,1 mm, de Sete Pedras, São Tome, 10 m (CSG); G-K: conchas 6,9; 7,8; 7,8; 7,5; 7,9 mm, Lagoa Azul "Fundão", São Tomé (CSG).*

with numerous axial irregular lines; the lower one formed by large isolated blotches, usually with oblique extensions and sometimes with two of them fused; the lower dark band is present around the middle of the last whorls and is almost formed by axial irregular lines. The spaces between them are white with cream-orange lines or small, very variable blotches.

The soft parts, described by GOFAS & FERNANDES (1988: pl. 1a) are whitish.

Dimensions: the holotype is 6 mm, and the population has a similar size; larger specimens of the new found population reach 8.0 mm.

Remarks: The species is represented and described in GOFAS & FERNANDES (1988). This description is coincident with the original description and the holotype. The population from Lagoa Azul has shells which are a little larger and lighter in colour but probably within the variability of the species.

Marginella spinacia Gofas & Fernandes, 1988 (Figure 8 A-M)

Marginella spinacia Gofas & Fernandes, 1988: [Type locality: Esprahinha].

Type material: Holotype in MNHN (represented in GOFAS & FERNANDES, 1988: figs. 2a, 2b); paratypes in many collections.

Other material examined: São Tomé: 120 sp, 10-15 m, Lagoa Azul-Morro Carregado (CSG); 107 sp, Esprainha, 2-10 m (MHNS); 87 sp, Ponta de Diogo Vaz, 12 m (CSG); 56 sp, Lagoa Azul-Morro Carregado, 11 m (CSG); 12 sp, Lagoa Azul, South side, 12 m (CSG); 30 sp, 8 s, Kia Reef, 15 m (CSG); 14 sp, Baia Ana Chaves, 22 m (CSG); 2 sp, Pedra Conchas, 20 m (CSG); 10 sp, São Tomé Capital, 10 m (CSG); 10 sp, 20 s, Lagoa Azul "Fundao", 30 m (SC); 10 sp, 25 s, Lagoa Azul "Fundao", 36 m (CSG); 1 sp, Ilheu Santana, 20 m (CSG); 7 sp, 8 s, Minerio 43 m (CSG); 250 sp, Lagoa Azul-Morro Carregado, 8-12 m (MHNS). Principe: 75 sp, Baia das Agulhas, 10 m (CSG).

Description: See GOFAS & FERNANDES (1988).

Dimensions: Usually between 7.0-8.0 mm, only exceptionally the largest shells reach up to: 11.2 mm

Remarks: This species was described from São Tomé (GOFAS & FERNANDES, 1988) and it was presented as a dark shell, with typical pattern and scarce variability, and collected between 2-5 m in depth. In recent collections by the second author (SG) the species was found down to 30 m, the deep populations being lighter in colour (Figures 7G-K). It was collected also from Principe Island recently in larger quantity (Figures 8M). This species was recorded in this island for the first time by ROLÁN & FERNANDES (1992).

We show here the high variability of this species, so that those who are prone to describe new species with such great ease understand that it is preferable to know better the variability of populations before creating new and needless taxa erroneously.

Marginella michelae Cossignani, 2012 (Figure 9 A-J)

Marginella michelae Cossignani, 2012. *Malacologia*, 75: 30. [Type locality: "Isola de Principe, São Tomé, Tennosa Pequeña"].

Type material: Holotype in MMM, Cupra Marittima.
Other material examined: São Tomé: 3 sp, 1 s, East Sete Pedras, on spheroid concretions of the coralline alga *Lithothamnion coralliodes*, 30 m (CSG).

Description: See COSSIGNANI (2012).

The soft parts are milk white;under magnification it can be seen that the background is a little transparent and there are many very small milk-white dots.

Distribution and remarks: COSSIGNANI (2012) described this species based on scarce material. Furthermore, the description of *Marginella michelae* has an important error, because the author indicated as type locality "Isola di Principe, São Tomé, Tennosa (sic) Pequena". The second author of the present work (SG) has dived extensively in Principe, in São Tomé and in Tinhosa Pequena (this is the exact name). The present species has been found only in a small area around Sete Pedras, Southeast of São Tomé Island, at 27-30 m, collected on spheroid concretions of the coralline alga *Lithothamnion coralliodes*. This must be considered the real type locality.

Marginella colombi Cossignani, 2012 (Figures 10 A-L, 11 A-K)

Marginella colombi Cossignani, 2012: 31, figs. without number. [Type locality: stated as "Isola de Principe, São Tomé, Tennosa Pequeña", see remarks].

Type material: Holotype in MMM.
Other material examined: Principe Island: 10 sp, Ponta Cabra, Baia de Santo Antonio, 12 m (CSG); 2 sp, Sete Brazas, 21 m (CSG); 10 sp, 1 j, Tinhosa Grande, 15 m (CSG); 6 sp, Tinhosa Grande, 16 m (CSG); 6 sp, 2 s, Tinhosa Grande, 20 m (CSG); 5 sp, 2 s, Tinhosa Grande, 12 m (CSG); 1 sp, Tinhosa

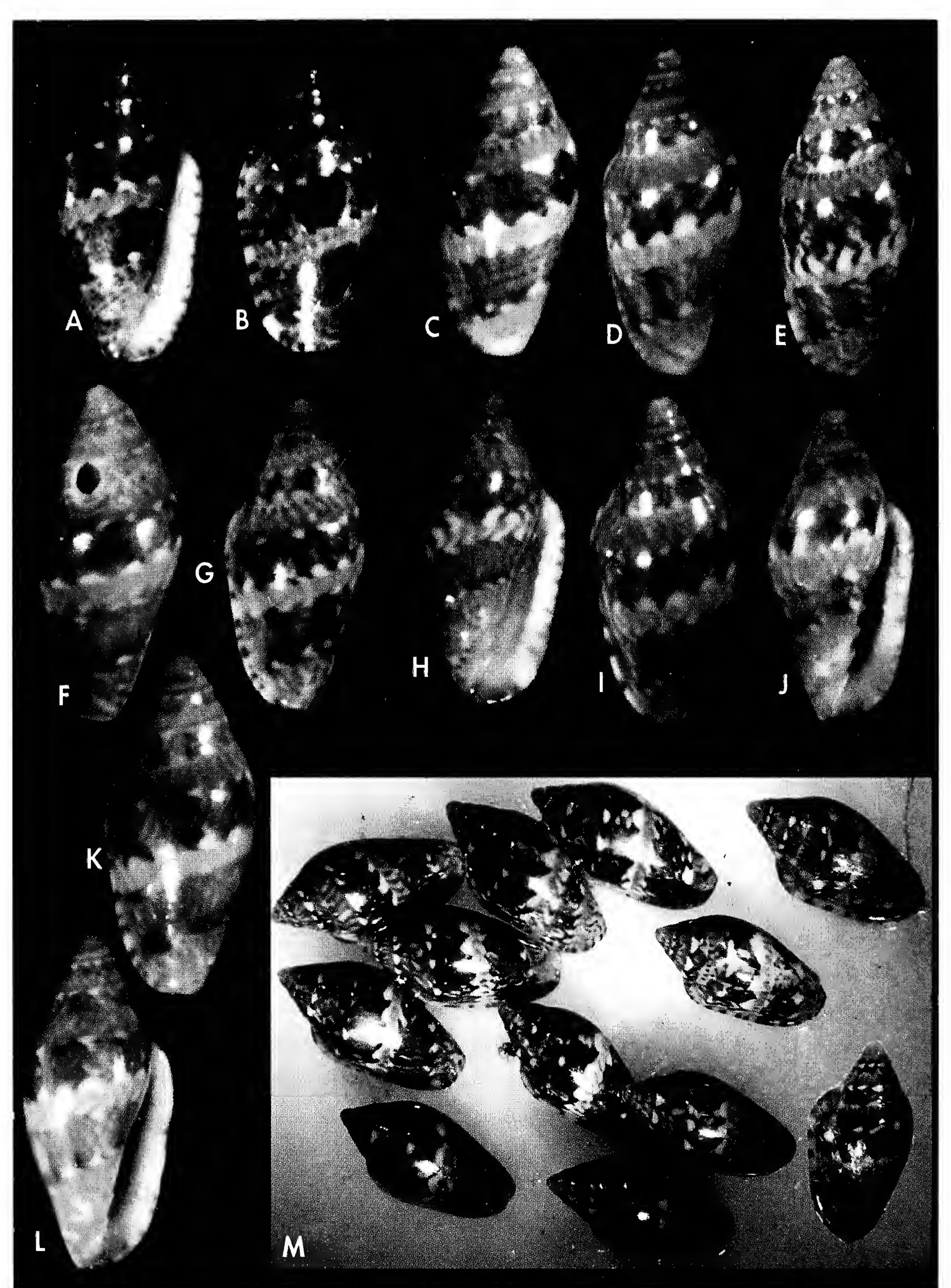


Figure 8. *Marginella spinacia* Gofas & Fernandes, 1988. A, B: 7.0 and 7.1 mm, typical pattern, Lagoa Azul, 15 m (CSG); C, D: 7.2, 8.1 mm, light pattern, Lagoa Azul, 15 m (CSG); E-L: 9.0, 10.2, 8.5, 8.6, 8.8, 8.3, 9.0 mm, variable patterns, Lagoa Azul, 28 m (CSG); M: lot of shells from Principe, Baia das Agulhas (CSG).

Figura 8. Marginella spinacia *Gofas & Fernandes, 1988. A, B: 7,0 y 7,1 mm, patrón de color tipico, Lagoa Azul, 15 m (CSG); C, D: 7,2 y 8,1 mm, patrón claro, Lagoa Azul, 15 m (CSG); E-L: 9,0; 10,2; 8,5; 8,6; 8,8; 8,3; 9,0 mm, patrones variables, Lagoa Azul, 28 m (CSG); M: lote de conchas de Principe, Baia das Agulhas (CSG).*

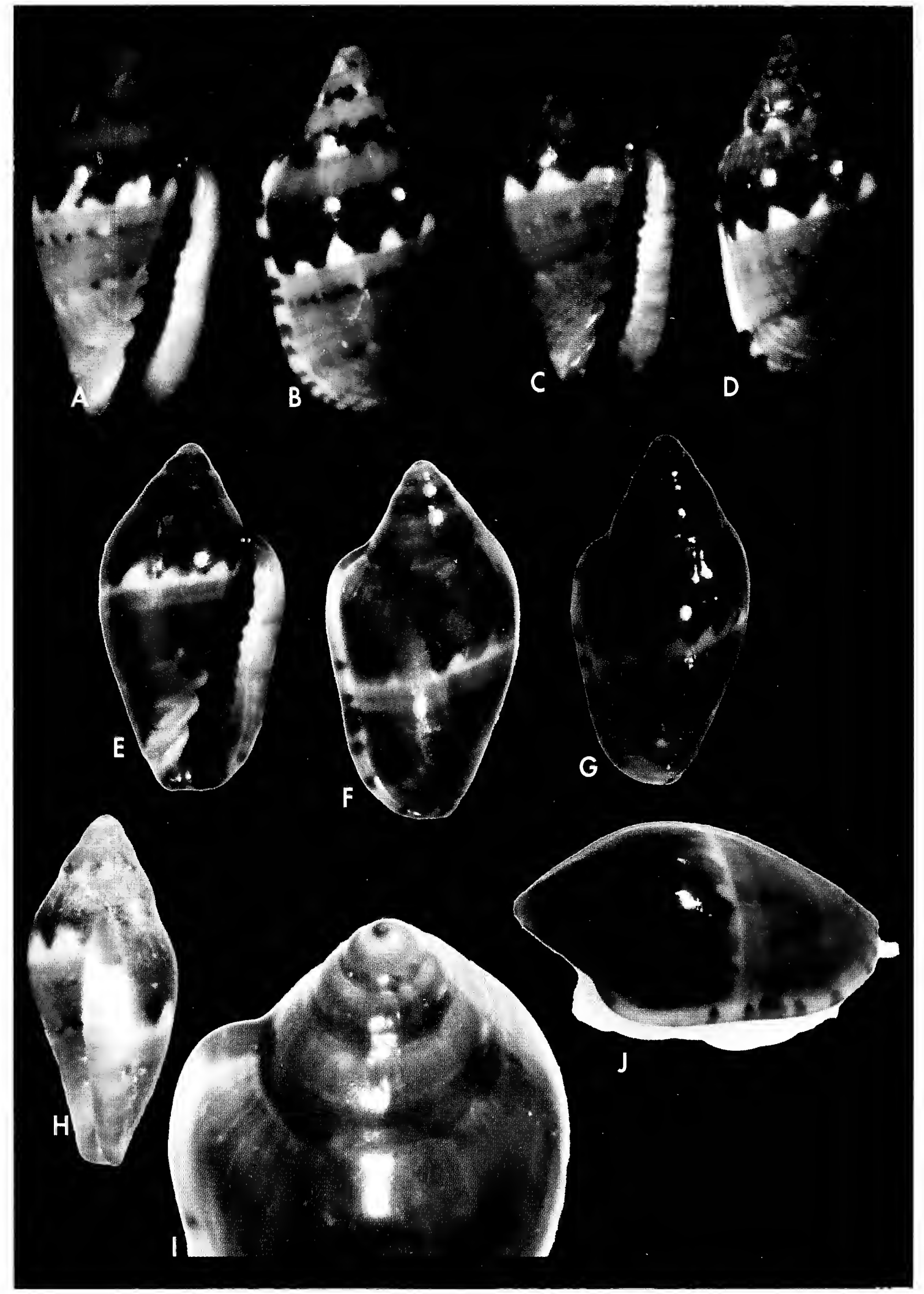


Figure 9. *Marginella michelae* Cossignani, 2012. A-H: shells. A, B: 10.3 mm; C, D: 9.6 mm; E, F: 9.6 mm; G: 9.6 mm; H: 9.7 mm; all from CSG. I: view of the apex; J: specimen of the Figures E and F, with soft parts.

Figura 9. Marginella michelae *Cossignani, 2012. A-H: conchas. A, B: 10,3 mm; C, D: 9,6 mm; E, F: 9,6 mm; G: 9,6 mm; H: 9,7 mm; todas de CSG. I: vista apical; J: ejemplar de las Figuras E y F, con partes blandas.*

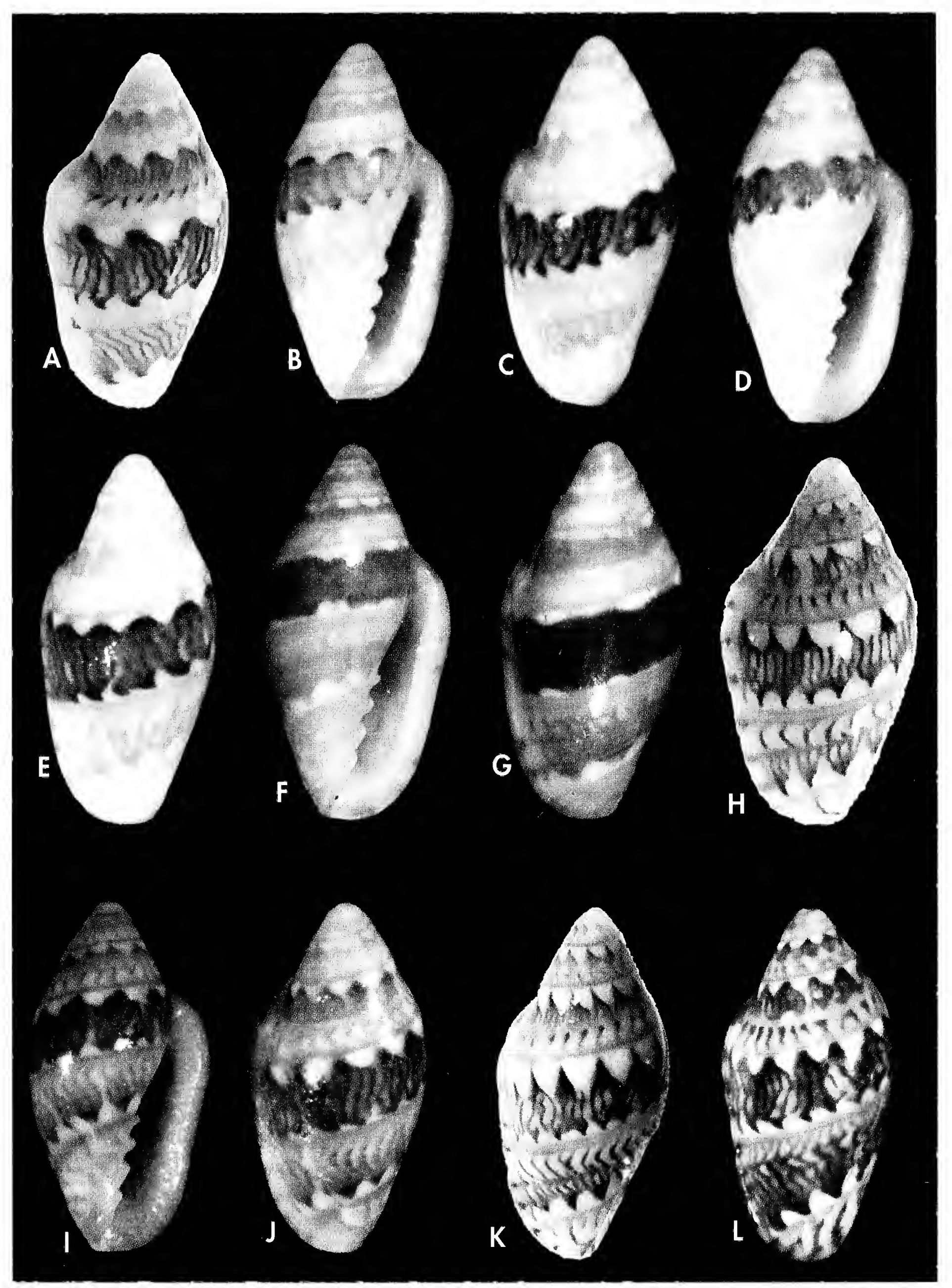


Figure 10. *Marginella colombi* Cossignani, 2012, shells with variable pattern. A: 6.3 mm (CSG); B-C: 6.5 mm; D-E: 6.5 mm; F-G: 6.6 mm; H: 6.5 mm: all from Sete Pedras, Principe (CSG); I-J: shell, 6.5 mm, Sete Brazas, Principe (CSG); K-L: shells, 6.3 mm and 6.6 mm, Ponta da Graça, Principe Island (CSG).

Figura 10. Marginella colombi *Cossignani, 2012, conchas con patrón de color variable. A: 6,3 mm (CSG); B-C: 6,5 mm; D-E: 6,5 mm; F-G: 6,6 mm; H: 6,5 mm: todas de Sete Pedras, Principe (CSG); I-J: concha, 6,5 mm, Sete Brazas, Principe (CSG); K-L: conchas, 6,3 mm y 6,6 mm, Ponta da Graça, isla de Principe (CSG).*

Grande, 25 m (CSG); 1 sp, Tinhosa Grande, 25 m (CSG); 10 sp, Sete Brazas, 20 m (CSG); 6 sp, Sete Brazas, 21 m (CSG); 7 sp, Sete Brazas, 20 m (CSG); 9 sp, west Sete Pedras, 18 m (CSG); 8 sp, Pedra Galé, 35 m (CSG); 36 sp, Pedra do Kaki, 16 m (CSG); 3 sp, off Ilheu dos Mosteiros, 20 m (CSG); 1 sp, Ponta da Graça, 16 m (CSG); 2 sp, Ponta da Graça, 17 m (CSG); 1 sp, Praia Evora, Santo Antonio, 7 m (CSG); 2 sp, Praia Evora, Santo Antonio, 9 m (CSG); 1 sp, west Tinhosa Pequena, 42 m (CSG); 2 sp, Tinhosa Pequena, 25 m (CSG); 6 sp, Tinhosa Pequena, 20 m (CSG); 4 sp, Bonné de Joquei, 12 m (CSG); 3 sp, 10 m (CSG); 1 sp, Pedra Galé, 10 m (CSG); 3 sp, Pedra Galé, 35 m (CSG); 1 sp, 1 s, Ilheu Santana, Santo Antonio, 10 m (CSG); 32 sp, 3 j, Baia das Agulhas, 10 m (CSG).

Remarks: This is one of the species we had under description and was preempted by the paper of COSSIGNANI (2012) based on only three shells. The type locality must be corrected to the exact name Tinhosa Pequena.

COSSIGNANI (2012) indicated as type locality "Isola di Principe, São Tomé, Tennosa (sic) Pequena", making the same mistake as for *M. michelae*. *Marginella colombi* has never been found in São Tomé, but only in Principe and the small islets around.

We have found two specimens that are completely white.

The variability of the shell can be shown in the following Figures 10 and 11.

Marginella britoi spec. nov. (Figure 12 A-K)

Marginella festiva Kiener: Sowerby, 1847: 382, pl.75, figs.72-73.

Type material: Holotype (Figs. 12A-B) MNHN (26624, sp); paratypes: MNCN (15.05/60086, 1 sp, Figs. 12C-D); MHNS (100603, 1 sp, Fig. 12E); CSG (4 sp); all from the type locality. Other paratypes: CSG (1 sp, Lagoa Azul "Fundao", 26 m, Figs. 12G-H) (1 sp, Pedra Branca, 30 m); CFD (1 sp. type locality; CPR (1 sp, Lagoa Azul "Fundao", 21 m); CFB (1 sp, Lagoa Azul "Fundao", 36 m); CSG (1 sp, Lagoa Azul "Fundao", São Tomé, 33 m, Fig. 12I); CJR (1 sp, Lagoa Azul "Fundao", 30 m.
Other material studied: São Tomé: 2 s, eroded, from Type locality (CSG); 2 s, 1 s eroded, Lagoa Azul "Fundao", 30-34 m (CSG). Principe: 1 j, Tinhosa Pequena, 20 m (CSG).
Type locality: Ponta de Diogo Vaz, 12-21 m, 00°19'159"N, 06°29'633"E, São Tomé Island.
Etymology: The specific name is after the native diver Elder "Dede" Brito, who helped during diving collections.

Description: Shell elongate with maximum dimensions varying in different populations, solid, shiny with a prominent spire. The colour is dark except for one band in the middle of the last whorl which has irregular borders and may be variable in width; the dark part of the shell has brown and red alternating, this last colour in subsutural position. Darker lines reach the thickening of the external lip which is whitish or pink-cream and form there red-brown spots, which are more numerous on the anterior part.

Aperture narrow, a little wider in its lower part; columella with four plaits; external lip thickened and minutely denticulate interiorly (15-18 teeth).

Soft parts: animal totally white, with small milk white spots and some very small grey ones, and some elongate yellowish stripes on the caudal part.

Dimensions: The holotype is 12.2 mm. One shell reaches 20.2 mm. Other shells from Lagoa Azul and from Principe, are smaller than 10 mm.

Distribution: Known from São Tomé Island; few shells with similar pattern were collected in Principe I., in Tinhosa Pequena.

Habitat: The specimens from the type locality were collected under large stones, in 12-24 m. However those from Lagoa Azul were collected washing the dead coral *Tubastrea aurea* (Quoy & Gaimard, 1830) from deeper water.

Remarks: We consider populations from the type locality (Ponta de Diogo Vaz, São Tomé) and those from Lagoa Azul (São Tome) and Tinhosa Pequena

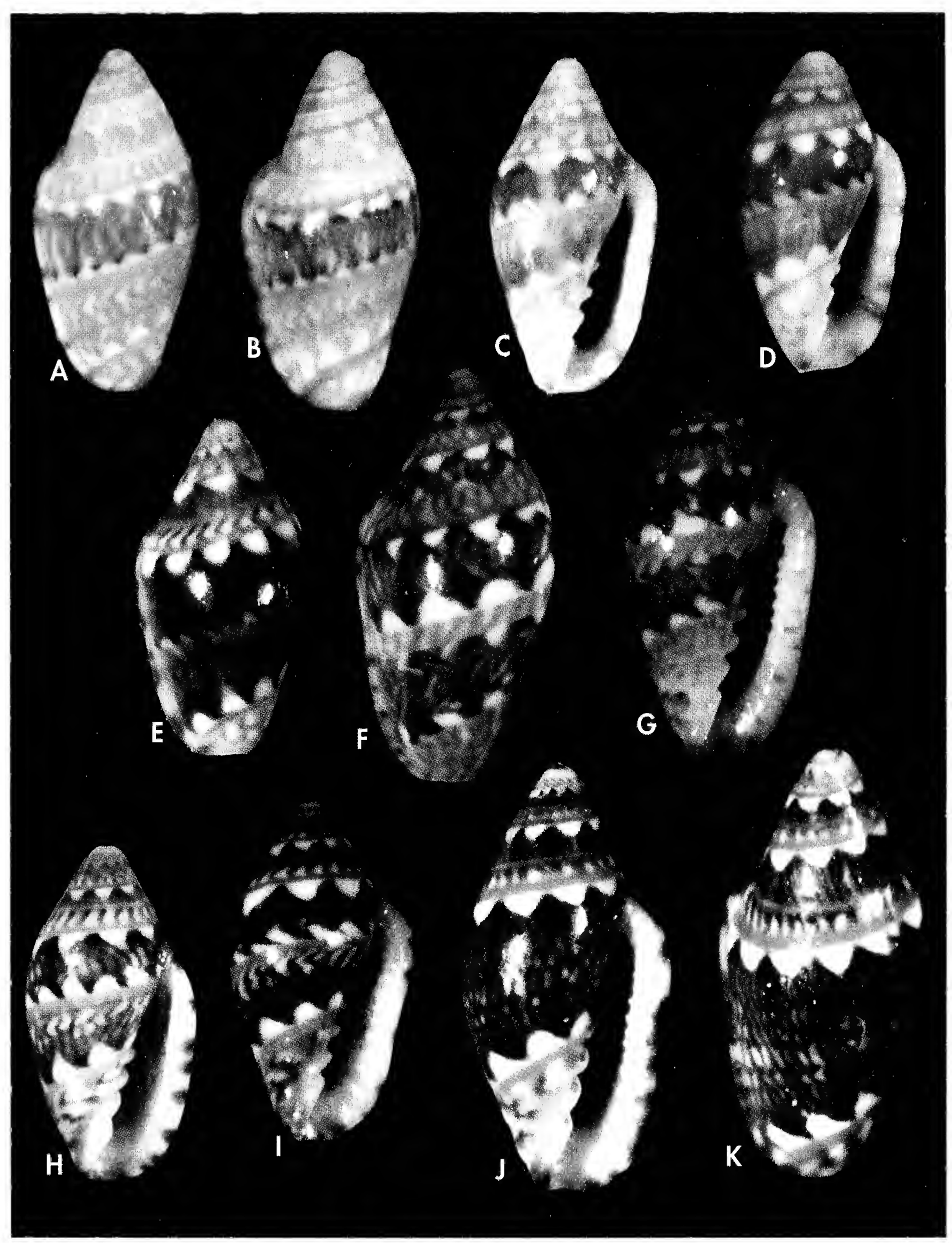


Figure 11. *Marginella colombi* Cossignani, 2012, shells with variable pattern. A, B: 6.2 and 6.7 mm, Sete Brazas, Principe (CSG); C-E: shells, 5.7, 5.5, 5.6 mm, Sete Brazas (CSG); F, G: shells, 8.1 and 7.4 mm, Tinhosa Grande, Principe (CSG); H: shell, 6.1 mm, Ponta da Graça, Principe (CSG); I: shell, 5.8 mm, Tinhosa Grande, Principe (CSG); J, K: shell, 8.8 mm, Bonné de Joquei, Principe (CSG).

Figura 11. Marginella colombi *Cossignani, 2012, conchas con patrón de color variable. A, B: 6,2 y 6,7 mm, Sete Brazas, Principe (CSG); C-E: conchas, 5,7; 5,5; 5,6 mm, Sete Brazas (CSG); F, G: conchas, 8,1 y 7,4 mm, Tinhosa Grande, Principe (CSG); H: concha, 6,1 mm, Ponta da Graça, Principe (CSG); I: concha, 5,8 mm, Tinhosa Grande, Principe (CSG); J, K: concha, 8,8 mm, Bonné de Joquei, Principe (CSG).*

(Principe), to be conspecific, notwithstanding the fact that the latter are evidently smaller. They are equal in other characters.

The differences of *M. britoi* with other known species from São Tome and Principe Islands are found in the shell characters and the colour of the soft parts:

- *Marginella gemma* Adams, 1850 is very variable in pattern and colouration: most of their shells have 2 dark spiral bands bordered by narrower lighter bands which occasionally can be wider. *M. britoi* has a red line between the bands and two more on the last whorl. A white band is almost usual between the dark ones. *M. gemma* can also have wider cream or white areas but it lacks red spiral bands. *Marginella britoi* is relatively narrower in shape.

-*Marginella chalmersi* Tomlin & Shackleford, 1912 has a shell with very typical axial irregular lines in 2-3 bands. The animal is whitish with yellow spots in the tentacles.

-*Marginella spinacia* Gofas & Fernandes, 1988, is also dark, but smaller in size, reaching up to 8 mm, the pattern presents numerous spiral lines of minute spots, and the soft parts show numerous yellow and wine coloured oval spots.

- *Marginella michelae* Cossignani, 2012 has a shell with a deep red colour and is more biconical.

Marginella tyermani Marrat, 1876 (Figure 13 A-H)

Marginella tyermani Marrat, 1876: [Type locality: Corisco, Gabon].
Marginella eveleighi Tomlin & Shackleford, 1913: 11, pl. 1, figs 5-6. [Type locality: São Tomé Island].

Type material: Holotype of *Marginella tyermani* probably in Liverpool Museum: not examined. Holotype of *Marginella eveleighi* represented in Gofas & Fernandes (1988, figs. 12a, 12b)
Other material examined: Principe: 1 sp, Ponta Viro Viro, (CSG); 11 sp, Ponta da Mina, Santo Antonio, 10 m (CSG); 6 sp, Ponta da Mina, Santo Antonio, 6 m (CSG); 5 sp, 1 j, Ilheu dos Mosteiros, 16 m (CSG); 1 s, Chimalo and Hospital Velho (CSG). Gabon: 12 sp, 1 j, Pointe Denis, near mouth 1° river, south Boolkomo Estuary, 0.5 m (CCS).

Description: See Marrat (1876). The animal (Figs. 6E-G) has a transparent foot with numerous spots and rounded blotches of milky-yellowish colour. In the tentacles there is a line of spots. The siphon is yellowish and not transparent.

Distribution: Corisco, Gabon.

Habitat: On fine mud and muddy sand, 5-8 m.

Remarks: The most similar species are *M. mirandai* and *M. hernandezi* (see below).

Marginella mirandai spec. nov. (Figure 14 A-I)

Type material: Holotype (Figs. 14A-C) in MNHN (26625). Paratypes in the following collections: CSG (3 sp, Figs. 14D, 14F-G); CCS (1 sp, 1 j), from type locality; CSG (2 sp, 1 j), MHNS (100604, 1 sp, Fig. 14E), NMW (1 sp), CPR (1 s, 1 j), CJR (2 j) all from Praia Campana, NE of Principe, 15 m.
Other material examined: Principe: 2 juv, Ponta da Graça, Baia de Santo Antonio, 14 m (CSG); 1 juv, Praia Campanha, NE of the island, 15 m (CSG);
Type locality: Ponta da Graça, 01°37'856"N, 07°27'697"E, Baia de Santo Antonio, on sand, 14 m.
Etymology: The specific name is after Alberto Miranda, director of the Center Club Maxell of São Tomé for his help with the diving and collecting.

Description: Shell elongate with pointed spire, solid, shiny with a white background colour and black lines. The protoconch is rounded, whitish, not

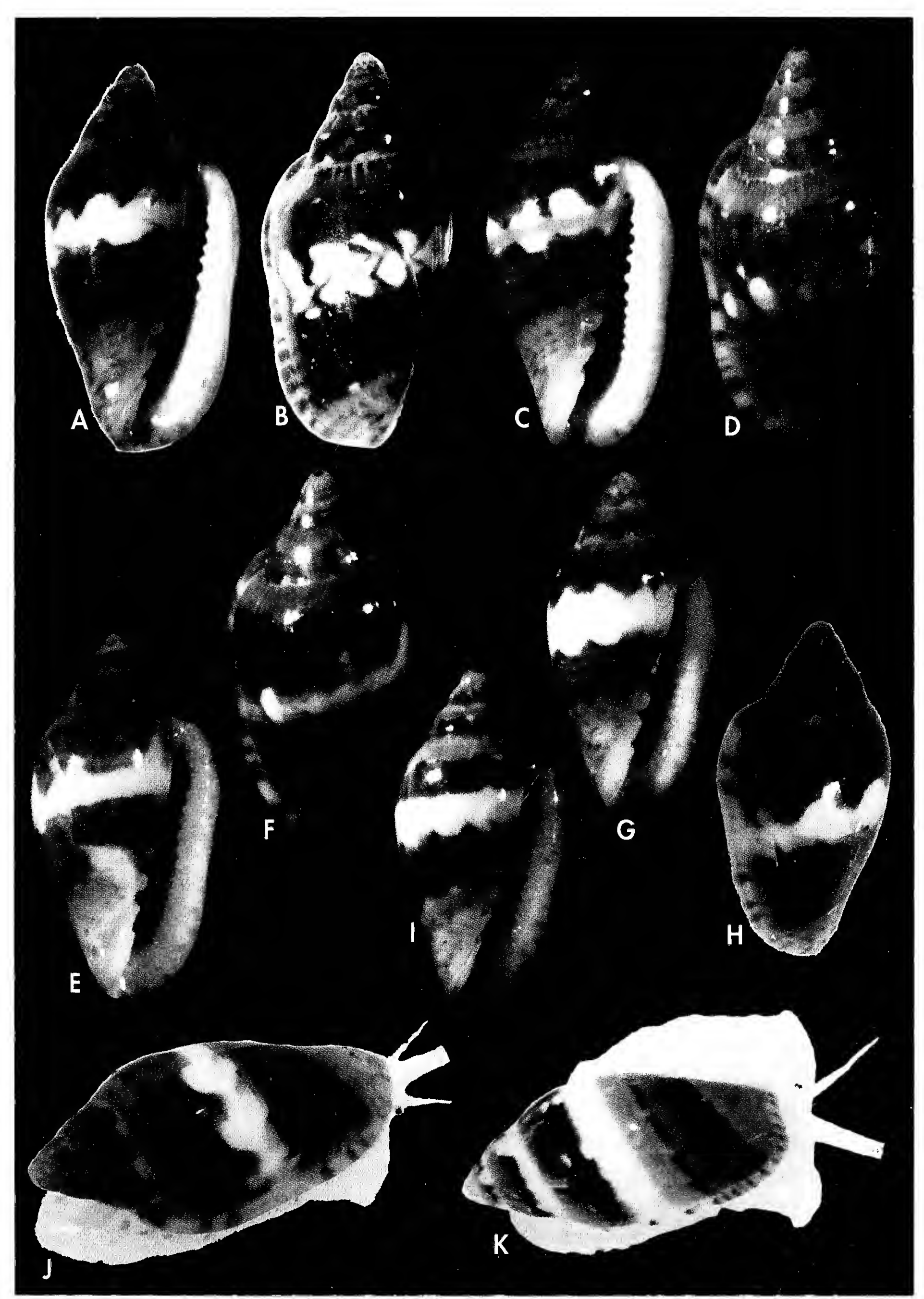


Figure 12. *Marginella britoi* spec. nov. A, B: holotype, 12.2 mm (MNHN); C, D: paratype, 12.8 mm (MNCN); E, F: paratype, 11.9 mm (MHNS); G, H: paratype, 10.8 mm (CSG), all from type locality; I: paratype, 9.4 mm, Lagoa Azul, São Tomé (CSG); J, K: specimens with soft parts.
Figura 12. Marginella britoi *spec. nov. A, B: holotipo, 12,2 mm (MNHN); C, D: paratipo, 12,8 mm (MNCN); E, F: paratipo, 11,9 mm (MHNS); G, H: paratipo, 10,8 mm (CSG), todos de la localidad tipo; I: paratipo, 9,4 mm, Lagoa Azul, São Tomé (CSG); J, K: ejemplares con partes blandas.*



Figure 13. *Marginella tyermani* Marrat, 1876. A, B: shells, 8.3 and 7.8 mm, from Ponta da Mina, São Tomé (CSG); C, D: Shells, 8.3, 7.3 mm, Gabon (CSG); E-G: living specimens from Ponta da Mina, São Tomé; H: lot of specimens from the same locality (CSG).
Figura 13. Marginella tyermani *Marrat, 1876. A, B: shells, 8,3 y 7,8 mm, de Ponta da Mina, São Tomé (CSG); Conchas, C, D: 8,3 y 7,3 mm, Gabon (CSG); E-G: Ejemplares vivos de Ponta da Mina, São Tomé; H: lote de ejemplares de la misma localidad (CSG).*

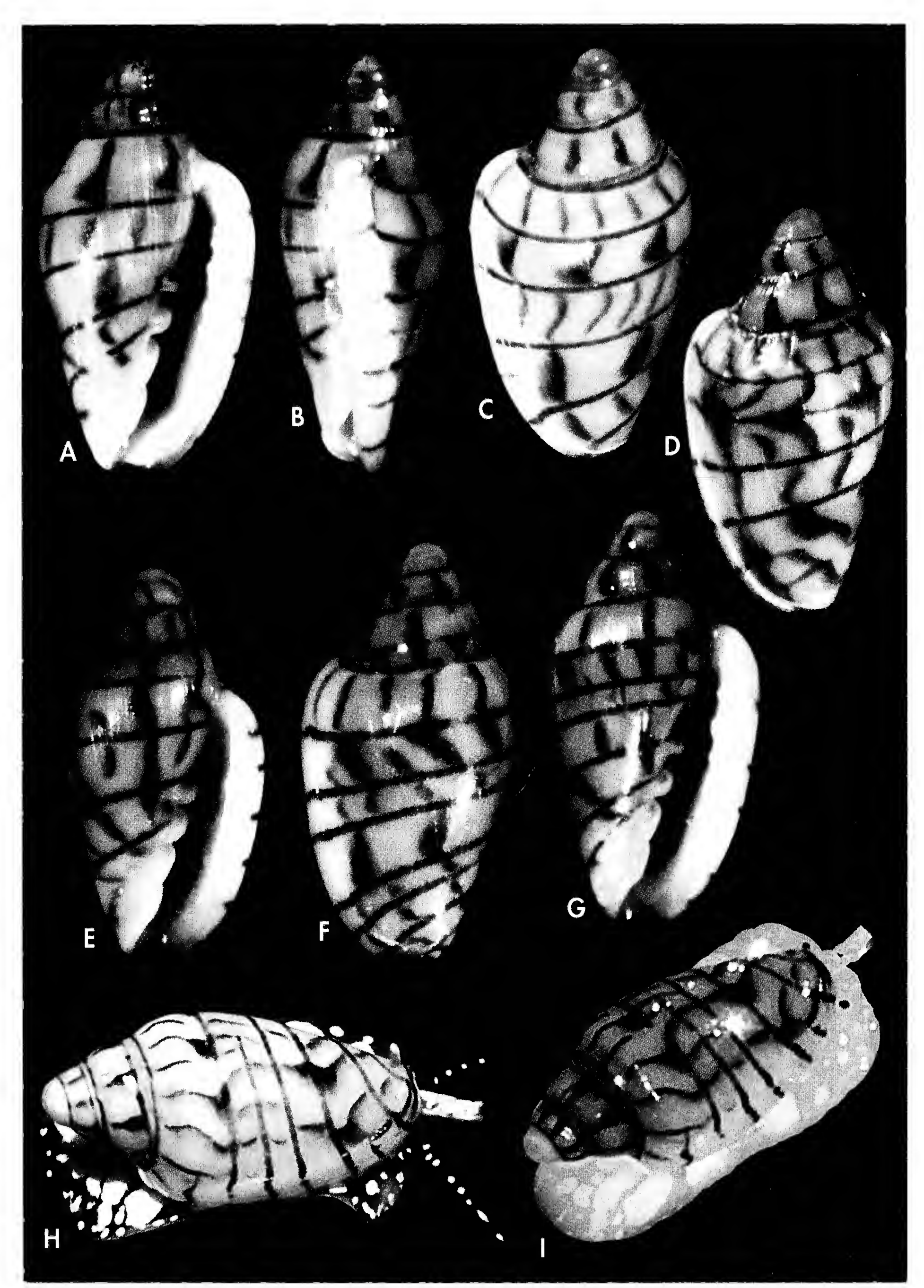


Figure 14: *Marginella mirandai* spec. nov. A-C: holotype, 6.7 mm (MNHN); D: paratype, 6.1 mm, from Baia da Graça (CSG); E: paratype, 5.5 mm (MHNS); F, G: paratype, 6.1 mm (CSG); H, I: the same specimen with soft parts on dark and light background.

Figure 14: Marginella mirandai *spec. nov. A-C: holotipo, 6,7 mm (MNHN); D: paratipo, 6,1 mm, de Baia da Graça (CSG); E: paratipo, 5,5 mm (MHNS); F, G: paratipo, 6,1 mm (CSG); H, I: El mismo ejemplar con partes blandas, fotografiado sobre fondo oscuro y claro.*

clearly separated from the teleoconch. This has about 3 ¾ whorls, which increase quickly. The last whorl is very prominent and represents more than about ¾ of the height. Aperture elongate, a little wider in its lower part; external lip white ,very widened; columella opisthocline, with 4 separated and very prominent folds, of which the three lower ones are very oblique; the portion without folds represents about 30-40% of its total length. The external pattern appears grey in general, with 6-7 fine spiral black lines on the last whorl, and only one on each of the first whorls. These lines are irregularly separated (the wider space is usually the subsutural) and between them appear short axial and very variable lines or blotches, frequently inclined in different directions.

Dimensions: the holotype is 6.7 mm. The paratypes are slightly smaller.

Soft parts whitish, transparent with numerous milk white spots and blotches, those situated anteriorly being smaller and the lateral and caudal ones larger. These milk white spots appear also on the tentacles and are more numerous on the siphon.

Distribution: NE of Principe Island.

Remarks: This species at first glance may show some similarity to *M. tyermani*, but the latter species is larger, with a spire that is more pointed, and more numerous spiral dark lines. The axial lines and blotches in *M. mirandai* are usually limited to one interspace between spiral lines and the colour of the blotches on the soft parts is white instead of yellowish.

For the differences with *M. hernandezi* spec. nov. see below.

Marginella hernandezi spec. nov. (Figure 15A-K)

Type material: Holotype (Figs. 15A-B) in MNHN (26626). Paratypes: CSG (1 s, Praia das Burras, 18-20 m, Fig. 15D); CSG (3 s, 4 j, Baia das Agulhas, Fig. 15C); CCS (2 s) from the same locality; CSG (1 s, Fig. 15G); CSG (1 s, Fig. 15I), from Ponta da Graça,; MHNS (100605, 1 s, Fig. 15F), CPR (1 sp, Fig. 15H), and CJR (1 s, Fig. 15E), from Praia das Burras: all from Principe island.
Type locality: Principe I.: Baia das Agulhas, 01°36′06″N, 07°20′55″E, 15 m, on rocky bottom.
Etymology: The specific name is after José María Hernández, a Spanish malacologist, who passed away some time ago, visited São Tomé Islands several times and collected there with the authors.

Description: Shell elongate with pointed spire, solid, shiny with a grey colour. The protoconch is rounded, whitish, not clearly separated from the teleoconch. This has 3 ¾ whorls, which increase quickly. The last whorl is very prominent and represents ¾ of the height. On the dorsum, some shells can have very short and scarcely prominent axial ribs, not present in other shells. Aperture elongate, slightly wider in its lower part; external lip white, very widened; columella opisthocline, with 4 separated and very prominent folds which are very oblique, specially the lower ones and which take up about 60% of the length. The external pattern appears grey in general, with fine, spiral lines of dark grey, one on each of the first whorls and 10 on the last one, not regularly separated and crossed by irregular zigzag axial lines, which form two light bands with axial blotches.

The animal is transparent with small white to scarcely yellowish blotches on the foot, the siphon is light yellow and the tentacles transparent with small light yellow dots.

Dimensions: The holotype is 9.4 mm. The larger paratype is 9.8 mm.

Distribution: This species was found in Baia das Agulhas, diving, dredged at Praia das Burras and night diving at Ponta da Graça, Baia de Santo Antonio.

Habitat: Live material was found under sand, 3-15 m and under a thin layer of sand on flat rocks; also dredged at 20 m in dark sand mixed with spheroid concretions of *Lithothamnion corallioides*.

Remarks: This new species is different from any other of the islands species



Figure 15. *Marginella hernandezi* spec. nov. A, B: holotype, 9.4 mm (MNHN); C: paratype, 9.3 mm, type locality (CSG); D: paratype, 8.5 mm, off Praia das Burras (CSG); E: paratype, 8.4 mm, same locality (CJR); F: paratype, 7.4 mm (MHNS); G: paratype, 8.6 mm, Baia das Agulhas (CSG); H: paratype, 7.4 mm off Praia das Burras (CPR); I: paratype, 9.8 mm, Baia de Santo Antonio (CSG); J, K: living specimens on dark bottom.

Figure 15. Marginella hernandezi *spec. nov. A, B: holotipo, 9,4 mm (MNHN); C: paratipo, 9,3 mm, de la localidad tipo (CSG); D: paratipo, 8,5 mm, frente a Praia das Burras (CSG); E: paratipo, 8,4 mm, misma localidad (CJR); F: paratipo, 7,4 mm (MHNS); G: paratipo, 8,6 mm, Baia das Agulhas (CSG); H: paratipo, 7,4 mm frente a Praia das Burras (CPR); I: paratipo, 9,8 mm, Baia de Santo Antonio (CSG); J, K: ejemplares vivos sobre fondo oscuro.*

by its gray colour pattern, its wider aperture, wider thickened outer lip and prominent columellar folds. Some shells lack spiral lines, but we consider that they are the same species ,being equal in other characters.

Marginella tyermani Marrat, 1876 from Congo, Gabon and São Tomé has some remote similarity but this latter species has a shell which is strongly ribbed, with a greenish-yellowish colour, is more solid, relatively wider, the apex is wider, the columellar folds larger, the spiral lines are more marked, and the fine axial zigzag lines are almost always wanting. The animal is similar but the blotches on the foot are larger and more yellowish in *M. tyermani*.

M. mirandai spec. nov. is smaller, it has about 6 more marked spiral lines on the last whorl instead of those 10 fine lines in *M. hernandezi*; furthermore the pattern is different: *M. hernandezi* has irregular zigzag with axial lines more marked than the spiral ones, that are prolonged over the middle of the whorls, sometimes covering the complete shell; on the contrary, the pattern of *M. mirandai* has more predominant spiral lines, while the axial lines are not in zigzag but frequently shorter, rarely crossing the spiral ones. Both species live sympatrically.

Marginella fumigata Gofas & Fernandes, 1994, from Angola, is larger (13-16 mm), the two first whorls are smooth and the subsequent ones show axial ribs.

CONCLUSIONS

For the present work approximately 1500 specimens and shells of marginellids from São Tomé and Principe were examined, and several trips to both islands were necessary for collecting material, photographs and information. In the present work 4 new species are described, giving information on others previously known.

It seems evident that the West African coast is a paradise for the genera *Marginella, Volvarina, Granulina,* etc. with numerous endemic species living within short distances. Of these areas, some have a marked personality, such as those from Cape Verde Archipelago, Senegal, Ghana, São Tomé and Principe Islands, and Angola, which are the best recognized. In these areas, many species have been described during the last years of the last century and the beginning of this one and new papers are informing us continuously about new records and new species described. However many coastal areas are unexplored even now and so it is probable that further new species shall be described in a near future.

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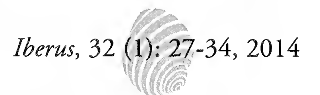
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An undescribed species of *Cryptosaccus* (Gastropoda: Hygromiidae) from the south-west of the province of León, NW Spain

Una nueva especie de *Cryptosaccus* (Gastropoda: Hygromiidae) del sur de Province León, NO España

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ABSTRACT

An unknown species of the family Hygromiidae, discovered among calcium-poor quartzite rocks at high altitude (*ca* 1879 m) on a mountain ridge in the Sierra de la Cabrera on the southern border of the province of León, is named here as *Cryptosaccus cabrerensis*. The shell characters and genital anatomy show strong similarities to *Cryptosaccus asturiensis* Prieto & Puente, 1994, as well as some clear differences. The new species has the accessory sac adjoining the dart sac visible externally during dissection, unlike *C. asturiensis*. Possible affinities of *Cryptosaccus* with other genera are discussed.

RESUMEN

Se describe una especie desconocida de la familia Hygromiidae, descubierta entre roquedos de cuarcita pobre en calcio, a gran altura (ca 1879 m) en una montaña en la Sierra de la Cabrera en la frontera sur de la provincia de León, bajo el nombre *Cryptosaccus cabrerensis*. Los caracteres de la concha y la anatomía del aparato genital muestran una fuerte similitud con *Cryptosaccus asturiensis* Prieto y Puente, 1994, así como algunas diferencias claras. La nueva especie tiene el saco accesorio junto al saco de dardo visible externamente durante la disección, a diferencia de *C. asturiensis*. Se discuten las posibles afinidades de *Cryptosaccus* con otros géneros.

INTRODUCTION

Cryptosaccus asturiensis was named in a new monotypic genus by PRIETO & PUENTE (1994) from rocky limestone habitats in the Somiedo Valley of Asturias province, NW. Spain, where it appears to be a localised endemic. In July 2013 an unknown species of Hygromiidae was found by the authors among calcium-poor quartzite rocks at high altitude (*ca* 1879 m) on a mountain ridge of the Sierra de la Cabrera on the southern border of León province. This did not match any of the species listed for León province or adjoining Zamora province in the comprehensive review by HERMIDA (1992). Investigation of its shell characters and genital anatomy have revealed strong similarities to *Cryptosaccus asturiensis* as well as some clear differences, so it is described here and named as a second species of the genus, *C. cabrerensis*.

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MATERIAL AND METHODS

Grid references of localities were obtained using hand-held Garmin GPS devices, in 2007 using a GPS 12 accurate to <10 m horizontally but considerably less accurate for altitudinal data, in 2013 using an Etrex High Sensitivity instrument accurate to <5 m both horizontally and vertically. Living snails were drowned in water overnight, then preserved in 80% Industrial Methylated Spirit.

Shells of the new species described below are weakly calcified, so they are remarkably thin, flexible and fragile. Hence, many of the empty shells are broken or distorted and measurement data are partly incomplete for that reason. Other shell measurements are incomplete because they are based on whole drowned specimens retained in spirit, with which the presence of the extended body prevents measurements of the aperture and umbilicus. It proved to be impossible to pull intact bodies from the shells of this taxon without destroying the shell, so that the anatomical material studied was limited to foreparts of four bodies that could be extracted, in three of them by making a hole in the underside of the penultimate shell whorl in order to cut through the body. Other specimens were left intact in spirit to allow future studies. Extraction of more of the body from the more calcified shells of *C. asturiensis* did not present any difficulty. Shell descriptions and dissections were carried out using a Meiji RZ Series stereo-microscope, drawings were made with assistance from a Meiji drawing tube, shell photographs with an Infinity1 camera and shell measurements were made with an eye-piece graticule. Shell whorls were counted using the method described by Kerney & Cameron (1979). Proximal and distal refer to the position in relation to the ovotestis.

Abbreviations: AH: maximum height of shell aperture; AW: maximum width of shell aperture; B: shell breadth; CGAH: Collection of G.A. and D.T. Holyoak; DTH: D.T. Holyoak; GAH: G.A. Holyoak; H: shell height; IMS: Industrial Methylated Spirit; MNCN: Museum Nacional de Ciencias Naturales, Madrid; n: sample size; NHMUK: The Natural History Museum, London; U: maximum width of umbilicus. The map references for localities are based on the U.T.M. grid. The material described is in CGAH, MNCN and NHMUK.

TAXONOMIC PART & RESULTS

Hygromiidae Tryon, 1866

Cryptosaccus Prieto & Puente, 1994; type species *C. asturiensis* Prieto & Puente, 1994 by original designation

Cryptosaccus asturiensis Prieto & Puente, 1994

Cryptosaccus asturiensis Prieto & Puente, 1994, Arch. Moll., 123: 112. [Type locality: 2 km al sur de Pola de Somiedo, en la base de la pared de un contrafuerte calcáreo. Prieto, Puente, Altonaga & Gómez-Moliner (2011: 878) pointed out that this was "entre Caunedo y Gúa" and that the UTM coordinates originally given as 29T QH 234 772 do not represent the type locality].

Material examined: Specimens all from Spain, in CGAH: (a) by AS227 N. of Pola de Somiedo, Prov. Asturias, 29T QH 232 769, E.-facing limestone crag and slopes, *ca* 655 m alt., 23 May 2007, GAH & DTH site E23, 1 dry shell & body in IMS, 13 specimens in IMS; (b) just E. of AS227 at *ca* 3 km S. of Santa Maria del Puerto, León province, 29T QH 261 655, limestone rocks and grassland on W.-facing slope, *ca* 1410 m alt., 25 & 26 May 2007, DTH site E27, dry shell & body in IMS, 2 specimens in IMS, 13 shells (dead when collected).

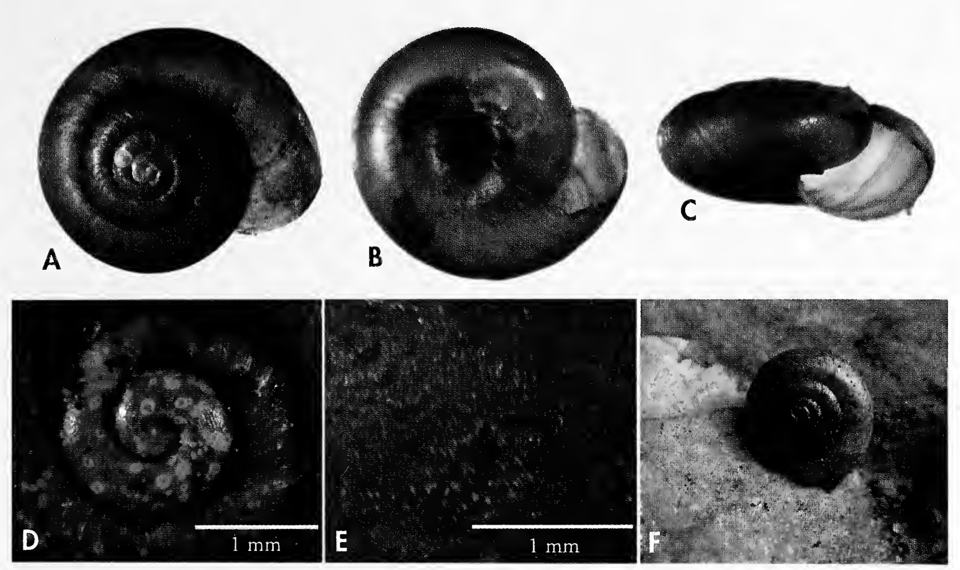


Figure 1. Shells of *Cryptosaccus cabrerensis* sp. nov. A-C: holotype (shell breadth 7.8 mm). D-F: paratypes from type locality. D: apical whorls to show microsculpture; E: "scaly" microsculpture on periphery of body whorl near aperture (to left of photograph); F: living animal aestivating on underside of quartzite boulder (shell breadth *ca* 7.5 mm).

Figura 1. Conchas de Cryptosaccus cabrerensis *spec nov. A-C: holotipo (ancho de la concha 7,8 mm); D-F: paratipos de la localidad tipo. D: vueltas apicales mostrando la microescultura; E: microescultura "escamosa" en la periferia de la última vuelta, cerca de la apertura (a la izquierda de la fotografía); F: animal vivo en estivación en la parte inferior de un bloque de cuarcita (ancho de la concha, unos 7,5 mm).*

When the species was named it was known only from the type locality, from steep limestone crags. PRIETO *ET AL.* (2011: 878) added three more localities, all within the Somiedo Valley, including a limestone wall and a road cutting. A "Vulnerable" Red List category is assigned to the species (GOMEZ, 2011; PRIETO *ET AL.*, 2011). Our site (b) listed above apparently represents a significant extension to the published data on the geographical and altitudinal ranges and recorded habitat of the species and the first record of it (just) outside the Somiedo Valley and (just) in León province.

Cryptosaccus cabrerensis G.A. Holyoak & D.T. Holyoak sp. nov.

Type material: Holotype (Figs 1A-C; reg. no. MNCN15.05/60087) from type locality, collected 1 July 2013 by G.A. Holyoak and D.T. Holyoak at site E334; forepart of body in spirit (IMS) and dry shell kept separately.

Paratypes: All from type locality with same collection data as holotype; 3 shells (dry) and incomplete bodies (foreparts in IMS), 5 specimens in IMS, 18 shells (dead when collected, mainly in poor condition) in CGAH; 1 specimen in absolute ethanol in NHMUK.

Type locality: *ca* 1 km W. of pass at Alto del Peñón (Sierra de la Cabrera, León province, Spain), 29T QG 0178 7555, *ca* 1879 m alt., unshaded quartzite scree adjoining low scrub high on N.-facing slope.

Etymology: PRIETO & PUENTE (1994: 110) stated that the generic name *Cryptosaccus* was derived from the greek *kryptos* = oculto (hidden) and the latin *saccus* = saco (sac). Our species epiphet *cabrerensis* is an adjective derived from Sierra de la Cabrera, the massif around the type locality. *Saccus* is a masculine noun and the latin suffix *-ensis* is in agreement with the generic name for the epiphets *cabrerensis* and *asturiensis*.

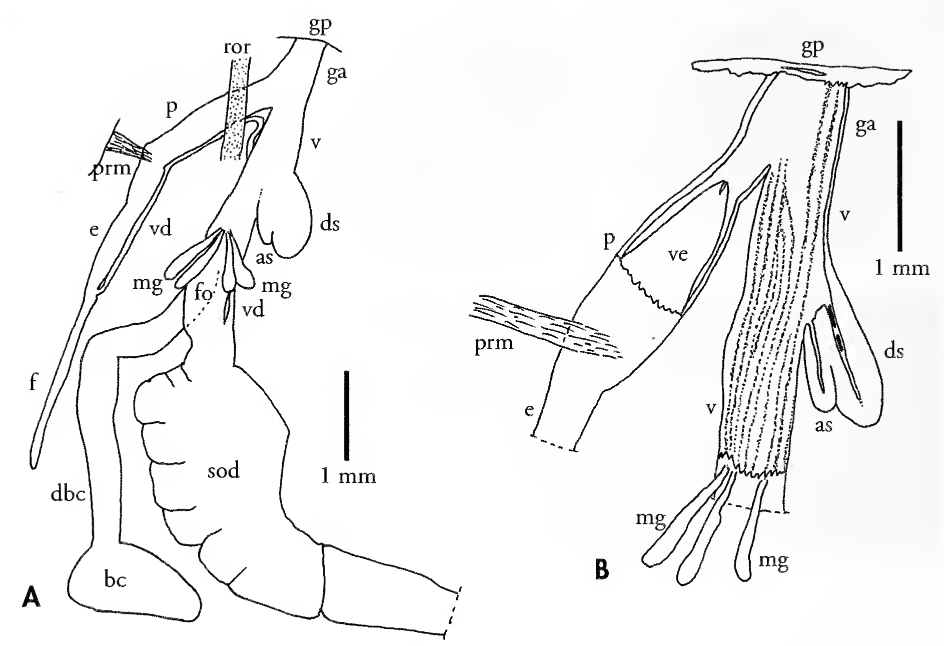


Figure 2. Anatomy of distal genitalia in *Cryptosaccus cabrerensis* sp. nov. A: holotype; B: partly schematic diagram of penis, vagina and dart sac complex in a paratype (showing longitudinal sections of dart sac complex and distal two-thirds of penis; the vagina and genital atrium opened and flattened to illustrate internal ridges). Abbreviations, as: accessory sac; bc: bursa copulatrix; dbc: duct of bursa copulatrix; ds: dart sac; e: epiphallus; f: flagellum; fo: free oviduct; ga: genital atrium; gp: genital pore; mg: mucus gland; p: penis; prm: penial retractor muscle; ror: right ommatophore retractor muscle; sod: spermoviduct; v: vagina; vd: vas deferens; ve: verge.

Figura 2. Anatomía de los órganos genitales distales en Cryptosaccus cabrerensis *spec. nov. A: holotipo; B: diagrama semiesquemático del pene, la vagina y complejo del saco del dardo en una paratipo (mostrando secciones longitudinales de complejo del saco del dardo y de los dos tercios distales de pene; la vagina y el atrio genital abiertos y aplastados para mostrar las crestas internas). Abreviaturas, as: saco accesorio; bc: bolsa copulatriz; dbc: conducto de la bolsa copulatriz; ds: saco del dardo; e: epifalo; f: flagelo; fo: oviducto libre; ga: atrio genital; gp: poro genital; mg: glándula del mucus; p: pene; prm: músculo retractor del pene; ror: músculo retractor del ommatoforo derecho; sod: spermoviduct; v: vagina; vd: vaso deferente; ve: verga.*

Description: Adult shell (Figs 1A-F) very depressed conical with flatter apex and somewhat flattened below. Breadth at maturity 6.9-7.9 mm (n = 10), height 3.4-4.5 mm (n = 9), H/B 0.49-0.61 (n = 9). Whorls 4.5-4.8 (n = 9), expanding regularly, rounded at periphery, distinctly flattened above, with moderately deep sutures. Umbilicus narrow, maximum width 0.7-1.1 mm (n = 4) (U/B 0.10-0.14, n = 4), deep and symmetrical, exposing inner edges of uppermost whorls. Aperture rounded-oval except where interrupted by penultimate whorl, slightly flattened below, maximum width 3.0-3.8 mm (n = 5), maximum height 2.7-3.5 mm (n = 6) (AW/AH 1.10-1.18, n = 5). Aperture lacking any internal rib; peristome thin throughout, plane except at umbilicus where narrowly reflected. Shell very thin, uncalcified, flexible when fresh, translucent, light brownish-green.

Shell surface with waxy lustre. Protoconch nearly smooth. Whorl 1.0-1.5 with distinct, regular, spiral ridges (Fig. 1D), which become much less obvious amongst other sculpture on later whorls. Irregular low transverse ribs or

striae (growth ridges) ± prominent from whorl 1.3 to shell aperture, these tending to be more strongly developed on top of shell in narrow band below each suture. Penultimate and body whorls with microsculpture on periostracum of closely spaced, shallowly crescentic transverse ridges giving a scaly pattern (their sides concave towards shell aperture: Fig. 1E), arranged in somewhat irregular spiral rows; these are absent from umbilicus and a broad zone around it on underside of shell. Shell hairs apparently lacking, but small immatures not seen.

Exterior of body with foreparts light grey above and towards foot-fringe, sides and sole of foot whitish; mantle whitish with irregular blotches and large spots of dark brown, these markings larger and darker (blackish) near right-hand edge, forming irregular lines. The dark markings are visible on living animals through the translucent shell (Fig. 1F).

Genital anatomy (Fig. 2), based on dissection of distal parts of bodies of four mature individuals: Genital pore located close behind lower tentacle on right-hand side of forepart of body at about mid-height. Genital atrium short, its proximal end of similar width to vagina, narrowing distally towards genital pore. Right ommatophore retractor muscle passes between penis and vagina. Penis moderately long, cylindrical, with penial retractor muscle inserted at its proximal end, the muscle short and wide to narrower and moderately long (two-thirds length of epiphallus), attached to body wall. Interior of penis studied in one specimen: distal two-thirds of penis comprised of an outer sheath that joins genital atrium at its narrower distal end; most of interior of sheath occupied by long-conical verge that tapers to a bluntly pointed tip at distal end, which has a large pore. Epiphallus long, the proximal part coiled. Flagellum long (up to 1.5× length of epiphallus), conical-cylindrical, in three individuals coiled on top of epiphallus when *in situ*, in fourth individual extended proximally inside body wall. Vas deferens a thin tube, ending at junction of epiphallus and flagellum, passing distally closely attached alongside epiphallus and penis to penial-vaginal angle (beneath right ommatophore retractor muscle), then returning proximally alongside vagina (beneath two mucus glands) and free oviduct. Vagina ± cylindrical, of similar length to penis but often somewhat wider, with large dart sac complex inserting externally at point about one-third below its proximal end. Inner wall of vagina (one examined) with nine high ridges that continue distally to middle of vagina; several ridges coalesce in distal one-third of vagina, leaving five or six ridges at its distal end, two of which continue along interior of outer part of genital atrium. The dart sac complex clearly a double structure when viewed externally, with outer part (dart sac) 2.5× width and of greater length than inner part (accessory sac). Dart sac muscular; one examined internally containing small dart (two broken white cylindrical pieces seen: *ca* 0.25 and 0.2 mm long, both of *ca* 0.05 mm diameter); narrow central canal of sac opens into vagina in a longitudinally elongate pore. The accessory sac not fused to adjacent wall of vagina for much of its length and free from dart sac for about one-half of its length, also muscular, with narrow central cavity (empty in one dissected) that opens as pore into vagina. Six, seven or eight mucus glands in four groups insert near proximal end of vagina; in one individual two groups each of two pairs arise on opposite sides of vagina, in other individuals one or two of glands not paired and their arrangement around vagina rather variable. All mucus glands short, narrowed at insertion and widening to a swollen bulbous proximal end. Free oviduct cylindrical, similar in thickness to vagina but about one-third its length. Duct of bursa copulatrix cylindrical, moderately wide throughout, nearly twice length of vagina and nearly as wide, coiled *in situ*. Bursa copulatrix thin-walled, closely appressed to and resting within curve of spermoviduct, in three individuals D-shaped with duct inserting obliquely on the rounded edge, in one individual oval but tapering into duct.

DISCUSSION

C. cabrerensis differs conspicuously from *C. asturiensis* in shell characters. Its shell is smaller (breadth up to 7.9 mm compared to 10 mm), with fewer whorls (up to 4.8 compared to 5.5-6), much thinner and more translucent, and the sculpture of projecting triangular scales on the periphery of the body whorl is much lower and less developed. Their genital anatomy is generally similar, differing most obviously in the dart sac of *C. cabrerensis* being accompanied by a smaller accessory sac that is visible externally during dissection, whereas in *C. asturiensis* the accessory sac is not visible externally, this character having formed the basis of the generic name *Cryptosaccus*. Also, the bursa copulatrix is much more elongate in *C. asturiensis* (length >5× width) than in *C. cabrerensis* (length 1-2× width).

Although the specific distinctness of *C. cabrerensis* from *C. asturiensis* can hardly be doubted, they nevertheless appear to be more closely related to each other than to any other Hygromiidae. Thus, they share a shell of similar general form, narrowly umbilicated with a simple peristome and with distinctive scale-like sculpture on the periphery of the body whorl. Among characters of the genital anatomy, they share a single dart sac with a small accessory sac joined along its inner edge, six to eight mucus glands inserting proximally to the insertion of the dart sac arranged approximately as two pairs each on opposite sides of the vagina, a long slender epiphallus and a long slender flagellum. They are also both rupestral species occurring in adjacent regions of NW. Spain, albeit separated by virtually the full width of León province (Fig. 3).

PRIETO & PUENTE (1994) pointed out the considerable biogeographic and ecological similarities between *Cryptosaccus asturiensis* and *Pyrenaearia* spp. However, they did not emphasise the close similarity between them in most characters of their genital anatomy, perhaps because *Pyrenaearia* differs in having the accessory sac visibly separate from the dart sac externally, often having the mucus glands inserting closer to the insertion of the dart sac, in addition to differences in shell sculpture (lack of scaly microsculpture; juveniles often with shell hairs). Nevertheless, since *C. cabrerensis* has an accessory sac that is visible externally, it prompts reconsideration of possible affinities with *Pyrenaearia*. A recent molecular-phylogenetic study of *Pyrenaearia* (ELEJALDE, MADEIRA, PRIETO, BACKELJAU & GÓMEZ-MOLINER, 2009) did not consider *Cryptosaccus*, but its detailed analytical data should now provide an excellent basis for future comparisons. Since *Zenobiella subrufescens* (Miller, 1822) also has similar genital anatomy (SCHILEYKO, 2005: 1961), a "scaly" pattern of shell microsculpture and a range extending to N. Spain it should also be compared, although its shell differs in having a very small umbilicus.

C. cabrerensis is known only from the type locality, on an exposed, gently N.-facing montane slope at *ca* 1879 m alt., close below a rocky ridge that forms a major watershed which represents the border between Province León and Province Zamora to the south (Fig. 3). The snails were concealed beneath the surface of an unshaded scree composed of boulders and large blocks of quartzite (Fig. 4). Most of them were close to the upper edge of the scree adjacent to dense low scrub (<0.5 m high), comprised of *Genista sanabrensis* Valdés Berm., Castrov. & Casaseca (the commonest bush), *Vaccinium myrtillus* L. and *Festuca* sp. with *Erica australis* L. *ca* 1 m high nearby. The flora and rock type indicate extremely calcium-poor conditions, with acidic soils.

Living *C. cabrerensis* occurred at low density, aestivating in the hot dry sunny weather mainly on the undersides of rocks (Fig. 1F); they had a thin membranous and translucent epiphragm inside the shell aperture. The only other mollusc we found there was a single dead shell of *Oxychilus* cf. *alliarius* (Miller, 1822).

3



4



Figure 3. Map of north-western Spain showing distribution of *Cryptosaccus asturiensis* and *C. cabrerensis* sp. nov. in ten kilometre squares of the U.T.M. grid. Figure 4. Habitat of *Cryptosaccus cabrerensis* spec. nov. at the type locality.

Figura 3. Mapa del noroeste de España indicando la distribución de Cryptosaccus asturiensis *y de* C. cabrerensis *sp. nov. en cuadrículas U.T.M. de 10 km. Figura 4. Hábitat de* Cryptosaccus cabrerensis *spec. nov. en la localidad tipo.*

Discovery of an undescribed species of *Cryptosaccus* among acidic rocks at such high elevation was unexpected. More widespread searching in the Sierra de la Cabrera and beyond will be needed to establish its range and conservation status.

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Estado de conservación de la náyade *Margaritifera margaritifera* (Linnaeus 1758) en el curso bajo del río Mandeo (A Coruña)

Status of the freshwater pearl mussel *Margaritifera margaritifera* (Linnaeus 1758) in the lower course of the river Mandeo (A Coruña)

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RESUMEN

Se estudian las densidades, la estructura por tamaños y la clasificación por edades de una población de la náyade *Margaritifera margaritifera* en el curso bajo del río Mandeo (A Coruña). Se seleccionaron tres parcelas de estudio en el año 2000 que fueron nuevamente estudiadas en el año 2010, año en el que además se añadió una cuarta parcela. Las densidades no difirieron de manera significativa entre los dos años de control, mientras que la distribución por tamaños mostró un claro dominio de los ejemplares adultos en todas las parcelas en los dos años considerados. En la parcela controlada únicamente en 2010 se registró una talla media superior a la de las otras zonas estudiadas, lo que unido al hecho de que sólo se hayan localizado animales jóvenes en puntos muy concretos del río, podría indicar una distribución no homogénea de los distintos grupos de edad. Aunque la fracción mayoritaria de la población está constituida por animales de entre 21 y 40 años de vida, la localización de ejemplares inmaduros apunta a que existe cierto grado de reclutamiento poblacional en el tramo estudiado del río Mandeo.

ABSTRACT

In this study the population density, size distribution and age classes of the freshwater pearl mussel *Margaritifera margaritifera* in the low stretch of the Mandeo river (A Coruña) are analysed. Three sampling plots were selected in 2000, which were studied again in 2010, when a fourth plot was added. Differences in density were not significant between years, and most sampled animals were adult in all plots and in both years. Freshwater pearl mussels found in the plot studied just in 2010 were significantly larger, and juvenile mussels were only found on certain areas of the river, suggesting a not homogenous distribution of different age classes along the river. Although most freshwater pearl mussels were 21-40 years old, some juveniles were also recorded, revealing some degree of current recruitment in the studied stretch of the river Mandeo.

INTRODUCCIÓN

La náyade *Margaritifera margaritifera* (Linnaeus 1758) se distribuye por las fachadas costeras atlánticas de Norteamérica y Europa, incluida la Rusia europea, en ríos árticos y atlánticos (SMITH, 2001). En Europa, GEIST (2010)

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cita su presencia en diecinueve países. Sin embargo, a pesar de esta extensa área de distribución, se trata de una especie en clara regresión a nivel mundial, actualmente catalogada como "en peligro" por la IUCN (2013). En Europa, las alteraciones provocadas por el hombre en sus hábitats han causado el envejecimiento de muchas poblaciones por falta de reclutamiento, cuando no su completa desaparición (Verdú y Galante, 2009). Entre los impactos más importantes cabe citar la construcción de obras hidráulicas (particularmente embalses) en los ríos; estas infraestructuras dificultan o impiden los movimientos de los salmónidos, especies sin las cuales la náyade no puede completar su ciclo vital, al ser las larvas (gloquidios) parásitos obligados de las mismas (Young y Williams, 1984; Bauer, 1987a, 1987b; Beasley y Roberts, 1999). Al mismo tiempo, los embalses provocan un cambio radical en el hábitat de la especie al disminuir la velocidad de la corriente y modificar los patrones de deposición de los materiales sólidos en suspensión (Moorkens, 2011). Otra causa importante de desaparición es la contaminación de las aguas, particularmente la de origen orgánico, que afecta a la especie fundamentalmente en su estado juvenil (Bauer, 1988; Young, 1991; Young, Cosgrove y Hastie, 2001).

En la Península Ibérica, esta náyade está presente actualmente únicamente en el cuadrante noroccidental. En Portugal, donde se consideró extinta durante muchos años (Young *et al.*, 2001), ha sido redescubierta en seis ríos de la cuenca del Duero, y al norte de esta en los ríos Cávado y Neiva (Reis, 2003; Varandas, Lopes-Lima, Teixeira, Hinzmann, Reis, Cortes, Machado y Sousa, 2013). En España, hoy en día se encuentra únicamente en un curso de Asturias (río Narcea; Álvarez-Claudio, García-Rovés, Ocharan, Cabal, Ocharan y Álvarez, 2000), en seis de Castilla y León (ríos Bibey, Negro, Tera, Castro, Águeda y Alberche; Velasco, Araujo, Bueno y Laguna 2002; Morales, Negro, Lizana, Martínez y Palacios, 2004; Velasco, Araujo, Balset, Toledo y Machordom, 2006; Araujo, 2006) y en Galicia. Precisamente en esta última región es donde mantiene su área de distribución más amplia y continua en la Península, ocupando un buen número de cursos que vierten sus aguas a las fachadas atlántica y cantábrica (Araujo, 2008). En una reciente revisión del estatus de la especie en Galicia, Lois, Ondina, Outeiro, Amaro y San Miguel (2013) citan su presencia en un total de 55 ríos, encontrando ejemplares juveniles en 11 de los mismos, lo que pone de relieve la importancia crucial de las poblaciones gallegas en la conservación de la especie en Europa. En el río Mandeo (A Coruña) hay referencias históricas de su presencia (Macho, 1878), mientras que la existencia de reclutamiento fue confirmada hace décadas (Bauer, 1986). Según el trabajo de Lois *et al.* (2013), el Mandeo sería el noveno río con mayor población estimada de la especie en Galicia (del orden de los 7.500 ejemplares), habiendo aún presencia de ejemplares juveniles, aunque en escaso número.

En el presente trabajo se aporta información sobre el estatus de la náyade de río en el curso bajo del río Mandeo, analizándose los cambios habidos en las densidades y en la estructura por tamaños y edades de una población estudiada con un lapso de diez años. Además, se discute la viabilidad de la población y las amenazas a las que actualmente se enfrenta la especie en este río.

MATERIAL Y MÉTODOS

Área de estudio

Con una longitud de 56 km, el río Mandeo nace en la sierra de A Cova da Serpe, a unos 700 m de altitud, y desemboca en la ría de Betanzos, en la provincia de A Coruña. Durante una serie de prospecciones realizadas en el año 1999 en los tramos medio y bajo del río, se determinó que la náyade de río estaba presente en la mayor parte de los puntos muestrados, si bien resultó ser especialmente abundante en los últimos kilómetros del curso (Figura 1). Así, en agosto de 2000 se procedió a delimitar tres par-

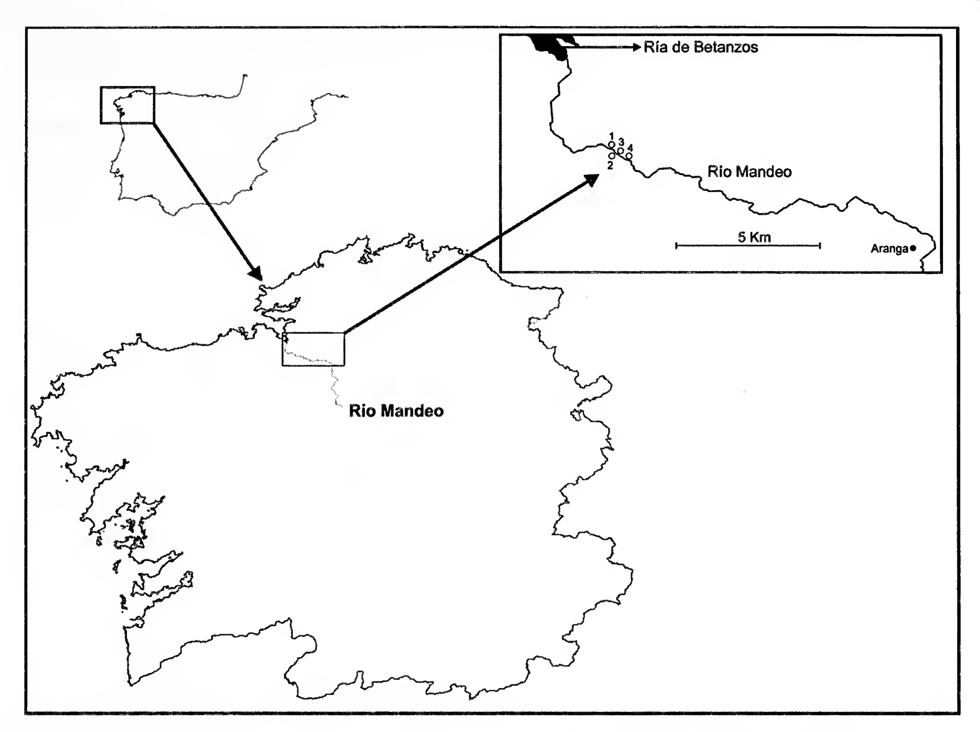


Figura 1. Área de estudio, indicando la localización aproximada de las parcelas estudiadas.
Figure 1. Study area, showing approximate situation of the sampled areas.

celas de estudio en el citado tramo, a las cuales se unió una cuarta parcela en agosto de 2010 (Figura 1). La elección de estos puntos de muestreo se realizó atendiendo a la heterogeneidad de biotopos que ocupa la especie en los ríos y que están caracterizados fundamentalmente por el tipo de sustrato, la profundidad y la cobertura de sombra proyectada por los árboles de ribera en el agua (GITTINGS, O'KEEFE, GALLAGHER, FINN Y O'MAHONY, 1998; HASTIE, PHILIP Y YOUNG, 2000) (Tabla I). En el primer año de trabajo la posición de cada parcela fue georeferenciada mediante un GPS, realizándose además distintos croquis que permitiesen su localización exacta en posteriores visitas.

Densidad y estructura de la población por tamaños

El censo de ejemplares presentes en cada parcela se realizó de manera visual mediante la realización de transectos longitudinales sistemáticos, cubriendo toda la extensión de los sectores del río delimitados. Cada transecto abarcó una banda de censo de un metro de ancho a cada lado del observador. Para evitar conteos múltiples de un mismo ejemplar se colocó una pequeña piedra de color claro, cogida en el propio lecho del río, al lado de cada náyade. El censo se dio por concluido cuando en sucesivas repeticiones de los transectos no se localizaron animales sin dicha piedra anexa. Cuando la visibilidad del fondo, por la luz o por la corriente, fue mala, se empleó un visor de fondo. En 2010 se obtuvo además un dato de densidad máxima en cada parcela, con el fin de comparar esta medida con la existente para otros ríos ibéricos. Este dato se obtuvo contando los ejemplares que quedaban englobados en un cuadrado metálico de un metro de lado que fue situado sobre las zonas con mayores agrupamientos de náyades. Todos los

Tabla I. Características físicas de las parcelas de estudio seleccionadas en el río Mandeo. Diámetros de las partículas del sustrato: piedra grande >20 cm; piedra pequeña 2-20 cm; grava 2-20 mm; arena < 2 mm.
Table I. Physical characteristics of sampled plots in the river Mandeo. Bottom particles diameters: large stone >20 cm; small stone 2-20 cm; gravel 2-20 mm; sand < 2 mm.

Parcela	Superficie m²	Prof. máx. (cm)	Tipo de sustrato	% en sombra
1	40	80	Piedra pequeña y grava	0
2	99	40	Piedra grande y arena	30
3	60	30	Piedra pequeña y arena	70
4	60	110	Piedra pequeña y arena	100

datos de densidades se presentan como ejemplares/m^2 (ej/m^2).En cada parcela se procedió a tomar la medida de la longitud máxima de la concha del mayor número posible de ejemplares con un calibre de 0,05 mm de precisión. Una vez medidas, las náyades fueron depositadas en su ubicación exacta y las piedras colocadas para su localización fueron retiradas.

Estructura de la población por edades

Los cálculos de las edades que correspondieron a una determinada longitud de la concha se realizaron empleando la fórmula de crecimiento no lineal de VON BERTALANFFY (1938), expresada como

$L_{(t)} = L_{inf}\,[1\text{-}e^{-k(t-t_0)}]$

donde t representa la edad, $L_{(t)}$ la longitud de la náyade a la edad t, L_{inf} es una constante que representa la longitud asintótica o la longitud teórica máxima que la náyade puede alcanzar cuando t tiende a infinito, K representa la constante de crecimiento y t_0 es la edad teórica a la cual la longitud de la náyade debe ser cero. En nuestro caso, los valores de L_{inf}, K y t_0 fueron obtenidos de los cálculos realizados por SAN MIGUEL, MONSERRAT, FERNÁNDEZ, AMARO, HERMIDA, ONDINA Y ALTABA (2004) para el propio río Mandeo.

Análisis estadístico

Los cambios en la densidad de las tres parcelas entre los dos años de estudio fueron analizados mediante el test de Wilcoxon. Las longitudes de las conchas se ajustaron a los supuestos de normalidad y homocedasticidad (prueba de Kolmogorov-Smirnov, $\alpha >$ 0,12 en todas las muestras), por lo que se analizaron mediante análisis de la varianza (ANOVA unifactorial). Finalmente, para analizar posibles variaciones en las frecuencias por categorías de tamaño entre parcelas y años se empleó el test χ^2. El nivel de significación para todos los análisis se fijó en 0,05.

RESULTADOS

Densidad poblacional

En el año 2000 se contabilizó un total de 168 ejemplares en el conjunto de las tres parcelas estudiadas, frente a 183 en 2010; la parcela 4, controlada únicamente en 2010, sumó 370 individuos (Tabla II). Atendiendo a las tres parcelas para las que hay datos de los dos años de estudio, las densidades observadas no difirieron de manera significativa en ninguna de ellas comparando los datos de 2000 y 2010 (Wilcoxon, $W = 3$, $P = 1$). Así, en 2000 la densidad fue máxima en la parcela 2, media en la 3 y mínima en la 1, situación que se repitió diez años después. La única diferencia destacable se dio en la parcela 2, donde en 2010 se detectó un aumento del 21% frente al número de ejemplares presentes en 2000. La mayor densidad de población se registró en la parcela 4, con 6,17 ej/m^2 y una densidad máxima de 50 ej/m^2.

Tabla II. Tamaño de la población, densidad (ejemplares/m^2) y tasa de cambio en las tres parcelas controladas en 2000 y 2010.
Table II. Population size, density (individuals/m^2) and population change rate recorded on the three studied plots in 2000 and 2010.

Parcela	nº ej 2000	nº ej 2010	ej/m² 2000	ej/m² 2010	Tasa de cambio 2000/2010
1	12	11	0,3	0,27	-8%
2	100	121	1,01	1,21	+21%
3	56	51	0,93	0,85	-9%
4	-	370	-	6,17	-

Distribución de tamaños

En el año 2000 se midieron 106 de los 168 ejemplares contabilizados (63%), mientras que en 2010 se midieron todos los ejemplares encontrados en las parcelas muestreadas en 2000 (n = 183) más una muestra de 100 ejemplares localizados en la parcela 4, lo que sumó un total de 282 ejemplares. Las longitudes en las parcelas 1-3 fueron similares entre sí tanto en 2000 (ANOVA unifactorial, $F_{2,103}$ = 0,87; P = 0,42) como en 2010 ($F_{2,180}$ = 0,81; P = 0,45). Así mismo, no difirieron en el conjunto de estas tres parcelas entre años ($F_{1,287}$ = 0,85; P = 0,36). Por el contrario, los ejemplares de la parcela 4 resultaron ser sensiblemente mayores que los de las parcelas 1-3 (ANOVA unifactorial para varianzas desiguales, $F_{275,8}$ = 40,33; P < 0,0001), mientras que 4 de los 5 únicos juveniles (longitud inferior a los 65 mm; HASTIE *ET AL.*, 2000; YOUNG *ET AL.*, 2001) medidos entre los dos años de estudio se encontraron en la parcela 2.

Tanto en 2000 como en 2010 y en las cuatro parcelas consideradas la gran mayoría de los ejemplares alcanzaron una talla de 80-100 mm (Tabla III, Figura 2). En el año 2000, las frecuencias por categorías de tamaño en la parcela 1, considerando sólo tres categorías en función de los tamaños de muestra (<80, 80-90 y >90 mm), no difirieron de las de la parcela 2 (χ^2 = 4,17; g.l. = 2, P = 0,12; n = 68) ni de la 3 (χ^2 = 2,03; g.l. = 2, P = 0,36; n = 50), mientras que estas dos últimas tuvieron poblaciones estructuradas de manera similar (χ^2 = 0,77; g.l. = 2, P = 0,68; n = 94). De las categorías de tamaño consideradas, la mayoritaria en todas las parcelas fue la de 80-90 mm. En el año 2010 aumentó considerablemente el número de náyades incluidas en la categoría 90-100 mm en el conjunto de la población (Figura 2). Una vez más, las frecuencias no variaron entre las distintas parcelas: parcela 1 vs. parcela 2: χ^2= 1,47; g.l. = 2, P = 0,48; n = 131; parcela 1 vs. parcela 3: χ^2 = 1,27; g.l. = 2, P = 0,53; n = 62; parcela 2 vs. parcela 3: χ^2 = 0,87; g.l. = 2, P = 0,65; n = 171.

Estructura de la población por edades y longevidad

La porción mayoritaria de la población medida en el río Mandeo en el año 2010, con una longitud de la concha de 80-100 mm, se corresponde con una edad de 21 a 40 años, siendo por tanto adultos reproductores; la población juvenil, formada por animales de <65 mm (Figura 3), representaría únicamente el 1% de la población. Entre las 389 náyades medidas en este estudio, la de mayor longitud, localizada en la parcela 4, alcanzó los 123,55 mm, correspondiéndole una edad próxima al máximo descrito para Galicia (65 años, según SAN MIGUEL *ET AL.*, 2004).

DISCUSIÓN

Cambios en la densidad y en la estructura de la población por tamaños

Las variaciones registradas en la densidad de las tres parcelas controladas en 2000 y 2010 no fueron significativas, lo que sugiere que la población se ha

Tabla III. Tamaño de muestra, media longitudinal y desviación típica de las poblaciones muestreadas en 2000 y 2010.
Table III. Sample size, average length and standard deviation of populations studied in 2000 and 2010.

Parcela	Muestra (*n*)	Media	Rango	Dv. típica
Año 2000				
1	12	85,17	70,90-92,60	5,88
2	56	87,18	48,40-116,20	8,36
3	38	85,08	57,70-97,80	8,19
Año 2010				
1	11	89,11	76,00-98,65	6,90
2	121	87,32	35,70-110,80	10,34
3	51	86,48	69,60-98,50	6,49
4	100	92,91	73,15-119,40	5,82

mantenido estable en el período de diez años considerado. Puesto que durante la realización del trabajo de campo no se detectaron transformaciones importantes en el hábitat de las parcelas estudiadas, ni la recolección directa de ejemplares, las variaciones observadas en el número de náyades presente en cada parcela podrían deberse a fenómenos de mortalidad natural (parcelas 1 y 3) o a la llegada de nuevos ejemplares arrastrados por la corriente en períodos de aguas caudalosas (parcela 2). El aumento registrado en 2010 del número de animales incluidos en la categoría 90-100 mm podría estar explicado simplemente por el crecimiento natural de los ejemplares, de unas décimas de milímetro anuales (SAN MIGUEL *ET AL.*, 2004), en el período considerado.

Las frecuencias de las distintas categorías de tamaño fueron similares entre parcelas en los dos años de estudio. Sin embargo, teniendo en cuenta el mayor tamaño de los ejemplares de la parcela 4 y que casi todos los ejemplares juveniles se encontraron en la parcela 2, es posible que la distribución de los distintos tamaños en el río no sea homogénea, si no que distintas zonas del río podrían tener condiciones adecuadas para el asentamiento de unas clases de tamaño determinadas (DUARTE Y DIEFENBACH 1994; GEIST Y AUERSWALD, 2007).

Sobre la viabilidad de la población

Las densidades observadas en el curso bajo del río Mandeo en el presente estudio (0,27-6,17 ej/m^2) son superiores a las estimadas para el conjunto del río (0,008-3,7 ej/m2; LOIS *ET AL.*, 2013), lo que indicaría que el tramo estudiado presenta condiciones particularmente favorables para la especie. La gran mayoría de los ejemplares localizados fueron adultos, siendo claramente minoritaria la fracción de la población formada por juveniles, que estuvo muy lejos del 25% estimado como necesario para que una población pueda ser considerada viable (HASTIE Y COSGROVE, 2002). La abundancia de juveniles es posible que haya sido subestimada, ya que durante esta fase las náyades permanecen preferentemente enterradas y para localizarlas es preciso tamizar el lecho del río (ZIUGANOV, ZOTIN, NEZLIN, TRETIAKOV, 1994; HASTIE *ET AL.*, 2000; HASTIE Y COSGROVE, 2002), lo que no se ha realizado en el presente estudio. Sin embargo, otros autores que sí realizaron búsquedas específicas de juveniles enterrados (LOIS *ET AL.*, 2013), citan la presencia de estos en un porcentaje bajo (5%) sobre el total de las unidades de muestreo en el Mandeo, destacando además que únicamente el 27% de las náyades juveniles en Galicia se encuentran enterradas en el sustrato. Por consi-

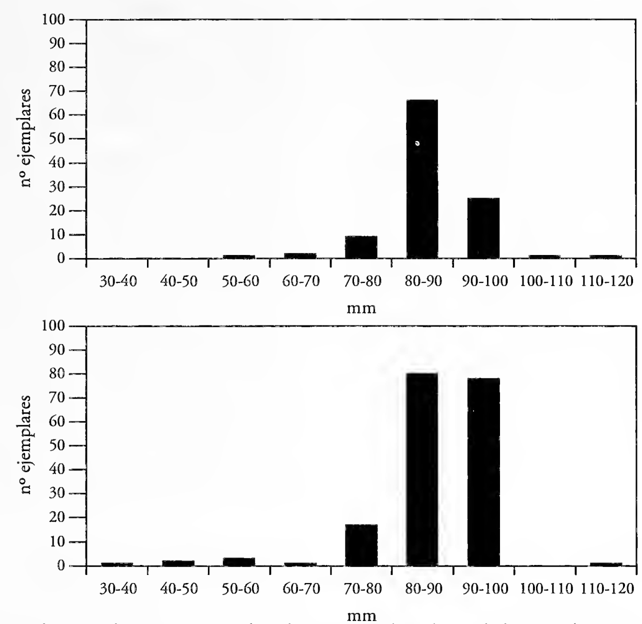


Figura 2. Número de náyades por intervalos de tamaño (mm) medidas en el conjunto de las parcelas 1-3 en 2000 (n = 106) (arriba) y 2010 (n = 183) (abajo).
Figure 2. Number of freshwater pearl mussels on each class size (mm) measured on plots 1-3 in 2000 (n = 106) (above) and in 2010 (n = 183) (below).



Figura 3. Ejemplar adulto de *Margaritifera margaritifera* de unos 100 mm de longitud junto a dos inmaduros de unos 45 mm, fotografiados durante la realización del presente estudio en el río Mandeo. En estos últimos son visibles a simple vista seis anillos de crecimiento anual.
Figure 3. An adult Margaritifera margaritifera *about 100 mm length along with two immatures about 45 mm length found during the present study on the river Mandeo. Six anual growth rings are easy visible in the latter.*

guiente, la información actualmente disponible apunta a que la presencia de juveniles en el río Mandeo es escasa, encontrándonos ante una población en claro proceso de envejecimiento.

Como conclusión, el hecho de que las densidades de náyades se hayan mantenido prácticamente invariables en el período de diez años considerado, sugiere que el curso bajo del río Mandeo mantiene un hábitat favorable para la especie. En este sentido, es de destacar que las densidades de salmónidos (particularmente de trucha común *Salmo trutta fario*) observadas en el Mandeo están muy próximas a las que registran algunos de los ríos con las poblaciones de náyades más importantes de Galicia, como el Eo o el Masma (HERVELLA Y CABALLERO, 1999; LOIS *ET AL.*, 2013). Sin embargo, es preocupante la escasez de náyades juveniles, lo que supone una amenaza el mantenimiento a largo plazo de la población. Durante la realización del presente estudio se detectaron distintas amenazas que se ciernen de manera preocupante sobre la población de náyades estudiada, pese a encontrarse incluida en el LIC Betanzos-Mandeo. Especialmente preocupante es el impacto derivado del funcionamiento de la central hidroeléctrica del río Zarzo, situada a unos 3 km aguas arriba de la zona de estudio. Particularmente en períodos de fuerte estiaje, la derivación de agua a la central provoca un brusco descenso del caudal del río, quedando entonces en seco muchas zonas habitualmente inundadas, que albergan poblaciones de la náyade. Estas bajadas periódicas del caudal han provocado la muerte por asfixia de cientos de ejemplares en zonas muy próximas a la estudiada en los últimos quince años (datos propios inéditos), suponiendo una amenaza muy seria para la conservación de la especie en el curso bajo del Mandeo.

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A new *Aforia* (Gastropoda: Conoidea: Cochlespiridae) from Galicia Bank (NW Iberian Peninsula)

Una nueva *Aforia* (Gastropoda: Conoidea: Cochlespiridae) del banco de Galicia (NO Península Ibérica)

Serge GOFAS*, Yuri KANTOR** and Ángel A. LUQUE ***

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ABSTRACT

A gastropod collected in 1720 m depth at the foot of the Galicia Bank is described as a new species in the genus *Aforia* (Cochlespiridae). The family placement is supported by the characters of the radula. The disjunct distribution (Northern Pacific, Antarctic and subantarctic areas, and here NE Atlantic) of species currently assigned to the genus *Aforia* is discussed.

RESUMEN

Se describe un gasterópodo recogido a 1720 m de profundidad al pie del banco de Galicia como una nueva especie del género *Aforia* (Cochlespiridae). Su inclusión en esta familia es acorde con los caracteres de la rádula. Se discute la distribución discontinua (Pacífico Norte, Antártida y áreas subantárticas, y aquí Atlántico NE) de las especies actualmente asignadas al género *Aforia*.

INTRODUCTION

The exploration of the deep-sea benthos of Western Europe has been active since the end of the XIX century and has increased spectacularly since the last two decades of the XX century. Nevertheless, contrary to the coastal area where the finding of a new species is now exceptional, there is still much to be discovered even among large and spectacular benthic animals of the bathyal and abyssal zones.

The Galicia Bank is a seamount located about 200 km west of the NW Iberian Peninsula, culminating at ca. 600 m depth on a large (ca. 6250 km^2) plateau, and separated from the mainland shelf by depths of ca. 2500 m in the Galicia Inner Basin. It is irregularly shaped, with the N-NW part gently sloping down to the abyssal plain and the eastern edge forming a cliff down to ca. 1800 m. The substrate is composed of basaltic lavas and oceanic crust, covered by sediments which are largely of pelagic origin (Ercilla, Casas, Vázquez, Iglesias, Somoza, Juan, Medialdea, León, Estrada, García-Gil, Farrán, Bohoyo, García & Maestro, 2011). Regarding

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water masses in contact with the sea bottom (Fiúza, Hamann, Ambar, Díaz del Río, González & Cabanas, 1998), the bank is reached from the South by quite diluted Mediterranean Outflow Water at two depth intervals, the upper core centred around 780 m and the lower, most saline core around 1100-1200 m. In the deeper part, North Atlantic Deep Water is present regionally with a core situated ca. 2500-3000 m, but a wedge of the fresher and colder Labrador Sea Water (LSW) situated around 1800 m and moving southwards, locally accentuates the gradient with the lower Mediterranean outflow.

The information about the bank and its ecosystems, and the few scientific surveys have highlighted the high concentrations of nutrients and the presence of deep-sea corals in the shallower part of the bank (Duineveld, Lavaleye & Berghuis, 2004). The bank has been visited by several expeditions in the past, among which the French Campaign SEAMOUNT 1 (Muséum National d'Histoire Naturelle, Paris, 1987), in which 12 stations were sampled (Bouchet & Métivier, 1988). In 2009, the Diva-Artabria II-09 campaign was conducted within the project "Latitudinal gradients of biodiversity in the deep sea of the Atlantic Ocean" and sampled Galicia Bank. Also in 2009, the Spanish Institute of Oceanography (IEO) conducted the ECOMARG programme on several sites of the northern Iberian margin including Galicia Bank. Although quite abundant material was obtained, no comprehensive list of molluscs was ever published and the only reports regard isolated species (e.g. Rolán Mosquera & Pedrosa, 1981), often in the context of broader taxonomic work (e.g. Bouchet & Warén, 1993; Gofas, 2007).

INDEMARES is an EU-funded LIFE+ project aimed at documenting ten offshore areas of Spanish waters as prospects for marine Natura 2000 areas, thereby fulfilling the commitments of the Marine Strategy Framework Directive of the EU. Galicia Bank is one of these ten areas and was the target of the cruise INDEMARES 0711 from July, 18 to August, 10 2011, with the R/V "Miguel Oliver" (of Secretaría General de Pesca, Spanish Ministry of Agriculture, Food and Environment), under the expedition leader Dr. Alberto Serrano (Instituto Español de Oceanografía). This expedition made operations with rock dredge (15 hauls, 779-1697 m depth), beam trawl (11 hauls, 744-1720 m depth) and otter trawl (9 hauls, 751-1764 m depth), along with box core samples, suprabenthic sled hauls, pelagic net operations, underwater video recording and CTD measurements.

Here we present the description of a large conoidean gastropod collected during the INDEMARES 0711 cruise. The unique specimen comes from the deepest beam trawl operation, situated in the transition zone between Galicia Bank proper and the Galicia Inner Basin, near the foot of the eastern cliff of the bank.

MATERIAL AND METHODS

During INDEMARES 0711 cruise, the beam trawl was towed for 15 minutes after settling on the bottom, at a speed of two knots. The mesh was 10 mm but consistently brought up a finer fraction as it got clogged by the sediment. The samples were sieved immediately on board, in sea water, on a set of 10, 5, 2 and 0.5 mm meshes; the two coarser fractions were sorted also on board and immediately fixed in 96° ethanol, and the specimen studied here was processed in this way. The finer fractions were mostly fixed in totality for posterior sorting in the lab.

The sample

Haul V10 was a successful beam trawl operation which brought on board over 10,000 macroscopic specimens totalizing over 9,600 grams (for the fractions sorted on board). The sediment was a pteropod ooze, in which shells of *Cavolinia inflexa* (Lesueur, 1813) were the most conspicuous component. The bottom sea-water temperature at the corresponding depth on the nearest CTD profile was 6.36 °C, and the salinity 35.3824 ‰. From the nearest box core (BC16, 42° 43.536′ N - 11°

28.128′ W, 1751 m), sediment was a poorly sorted very fine sand, with 2.411% over 500 µm, 51.280 % 63-500 µm and 46.309 < 63 µm, and had an organic matter content of 3.69%.

Most abundant species of the macrobenthos in terms of biomass were the deep-sea eel *Synaphobranchus kaupii* Johnson, 1862 (80 specimens, 1510 g) and the holothurian *Benthogone rosea* Koehler, 1895 (27 specimens, 1880 g). Other abundant elements collected alive were unidentified ophiuroids, the bivalves *Limopsis cristata* Jeffreys, 1876 (most abundant species overall, 702 specimens) and *Parvamussium propinquum* (Smith, 1885) (570 specimens), the large scaphopod *Fissidentalium capillosum* (Jeffreys, 1877) (150 specimens), the gastropods *Kryptos koehleri* (Locard, 1896) (129 specimens), *Amphissa acutecostata* (Philippi, 1844) (87 specimens) and *Scaphander punctostriatus* (Mighels & Adams, 1842) (59 specimens). In total, 37 live-taken molluscan species were identified in the sample (23 gastropods, 11 bivalves and 3 scaphopods). Shells of *Fissidentalium* occupied by sipunculids were also abundant. The haul also contained a single specimen of a large gastropod, which appeared to be a new species and is described herein.

SYSTEMATIC PART

Genus *Aforia* Dall, 1889

Type species: *Pleurotoma circinata* Dall, 1873 [Recent, Bering and Okhotsk seas], by original designation.

Aforia serranoi spec. nov. (Figs. 1-6)

Type material: Holotype, live taken specimen (MNCN15.05/60099)), BANGAL 0711, haul V10 (R/V "Miguel Oliver", 08 08 2011).
Type locality: East of Galicia Bank (42° 41.875′ N, 11° 26.708′ W, 1,720 m to 42° 42.36′ N, 11° 26.93′ W, 1,723 m).
Etymology: The species name is dedicated to the expedition leader Dr. Alberto Serrano, of Instituto Español de Oceanografía.

Description: Shell fusiform, comprising eight whorls, white, rather opaque. Protoconch comprising about 1.75 whorls, smooth and globose, corresponding only to protoconch I, with a maximum diameter of 1.2 mm, height 1.45 mm. Protoconch-teleoconch transition indistinct, indicated by the onset of a deep anal sinus and a keel. Teleoconch sculpture dominated by a distinct keel running near the middle of the whorls, slightly closer to the abapical suture, and a second keel, much less pronounced, running on the body whorl in continuation of the suture. Subsutural ramp very slightly concave just below the suture, then flat down to the main keel, covered by very faint, flat spiral cordlets and by flexuous growth lines reflecting the former positions of the anal sinus. Sculpture between keels and on the abapical part of the body whorl, of fine, flat and rounded spiral cords, much more definite than on the subsutural ramp. Subsutural ramp practically smooth on the three upper spire whorls, which have two low cords below the keel. Cords becoming more distinct on the subsutural ramp starting on fourth whorl, from 7 on the 4th whorl to 9 on the penultimate and last ones. Cords closely spaced, with variable width and interspaces variable from slightly broader than the cords to half the width of the cords. Number of cords below the keel increasing from 2 to 4 on fourth whorl and to 6 on penultimate whorl; six spiral cords between the keels on the last whorl and 23 on the shell base and canal. Body whorl prolonged by a tapering siphonal canal, which is not separated from the rest of the whorl by any discon-

tinuity of the profile. Aperture elongate-pyriform, tapering gradually towards the siphonal canal. Columellar and parietal edge continuous, lined with a very thin callus. Outer lip simple, rather thin, with a broad parabolic shaped anal sinus between the suture and the peripheral keel.

Dimensions: shell length 33.6 mm, width 11.2 mm; body whorl length 22.5 mm (measured along the axis on Fig. 1), aperture length (with canal) 17.9 mm, aperture length (without canal) 10.5 mm.

Animal rather stout, with a small head provided with cylindrical tentacles, blind. Operculum large, 8 mm in length, oval, spiral, with nucleus strongly shifted to left, semitransparent and brownish.

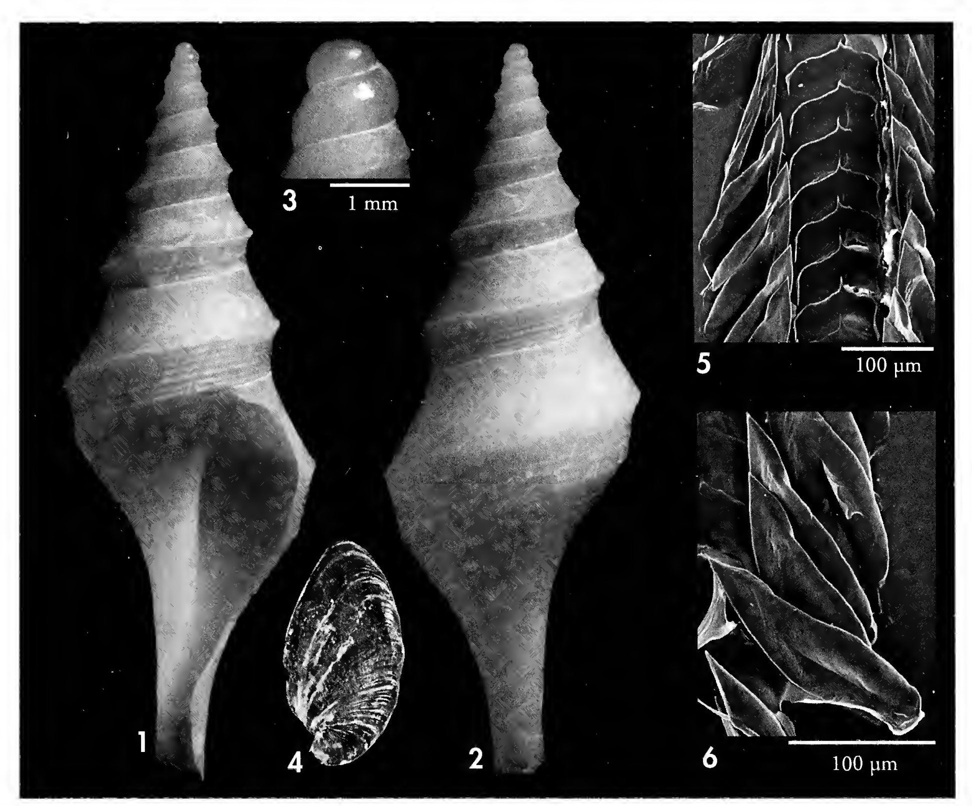
Radula relatively short, consisting of ca. 30 transverse rows of teeth, 10 nascent, 1.39 mm in length (13% of aperture length without canal). Radula comprising three teeth per row permanently attached to the basal membrane. Central tooth wide, weak, with arched posterior margin, with slightly elevated edges of posterior and lateral margins, and anterior margin indistinct, fused with the subradular membrane. A single small triangular cusp emanating from posterior margin. Lateral teeth small (length around 180 µm or 1.7% of aperture length without canal), duplex, rather flat, with pointed major limb with sharp edges, and large accessory limb of same length.

Systematic placement and species comparisons: *Aforia* is currently considered an extremely broadly distributed genus comprising 18 Recent species found from upper boreal waters in the Pacific to Antarctica (WoRMS, 2013). The integrity of the group has never been studied molecularly (only a single Antarctic species, *Aforia magnifica* (Strebel, 1908) can be found in Genbank). Therefore, the genus is currently defined mostly on rather loose conchological grounds and, to a lesser extent, on radular characters. Seven species of *Aforia* from north Pacific and three from Antarctic and sub-Antarctic waters have been studied in this respect, and all these have rather similar radulae, including *A. serranoi* spec. nov. However, the radula of all known Cochlespiridae species is very similar and hardly can be an ultimate proof that boreal, Antarctic and subantarctic species of *Aforia* are congeneric. Thus, pending additional molecular data on different *Aforia* species, we tentatively attribute the new species to the genus *Aforia* as broadly conceived on the grounds of shell and radula similarities with the other known species.

The type species of the genus, *Aforia circinata* (Dall, 1873) described from Alaska (Nateekin Bay, Unalashka, Aleutian Islands) is twice as large (the holotype measures 7.35 cm with a similar number of whorls) as *Aforia serranoi* spec. nov. and lacks the abapical keel, having instead the base of the body whorl regularly rounded. Similarly, the abapical keel is absent in all other species of *Aforia* described from the north Pacific (although most of them, except *A. kincaidi* (Dall, 1919) are currently considered as synonyms of *A. circinata*).

Other species of *Aforia* are known from Antarctic waters (Dell, 1990), among which *A. magnifica* (Strebel, 1908) and *A. multispiralis* Dell, 1990 most resemble the species described here. They share the configuration of spiral keels with flat spiral cords in between, but are twice as large and with a less acute spire in the former and more prominent keels in the latter. *Aforia staminea* (Watson, 1881), from Marion and Prince Edward and Kerguelen Islands is also larger than *A. serranoi* spec. nov., and lacks the abapical spiral keel (Watson, 1886). *Aforia goniodes* (Watson, 1881), described from Atlantic waters (Río de La Plata, Argentina), is smaller and stouter and also lacks the abapical keel (Watson, 1886).

Sysoev and Kantor (1987) reviewed on conchological and anatomical grounds the Pacific species of *Aforia* and close genera and described three new subgenera, one exclusively fossil. They also followed the opinion of Powell (1966) on the synonymy of *Irenosyrinx* Dall, 1908 (type species *Pleurotoma* (*Leucosyrinx*) *goodei* Dall, 1890, type locality north-western Patagonia, 1920 m) with



Figures 1-6. *Aforia serranoi* spec. nov. Holotype, MNCN15.05/60099, East of Galicia Bank (42° 41.87' N, 11° 26.71' W, 1720 m to 42° 42.36' N, 11° 26.93' W, 1723 m). 1, 2: ventral and dorsal view of shell, actual size 33.6 mm; 3: detail of protoconch; 4: operculum, largest diameter 8 mm; 5: partial view of the radula; 6: detail of marginal teeth.

Figuras 1-6. Aforia serranoi *spec. nov. Holotipo, MNCN15.05/60099, Este del banco de Galicia (42° 41,87' N, 11° 26,71' W, 1720 m, a 42° 42,36' N, 11° 26,93' W, 1723 m). 1, 2: vista ventral y dorsal de la concha, tamaño real 33,6 mm; 3: detalle de la protoconcha; 4: opérculo, diámetro mayor 8 mm; 5: vista parcial de la rádula; 6: detalle de los dientes marginales.*

Aforia (*Aforia*). The generic status of *Irenosyrinx* is not yet finally accepted, although in the latest classification (BOUCHET, KANTOR, SYSOEV & PUILLANDRE, 2011) the genus is listed questionably as a subgenus of *Aforia*.

BOUCHET AND WARÉN (1980) treated *Irenosyrinx* as a separate genus, and included one species described from the Western Atlantic, *I. hypomela* (Dall, 1889) (= *Surcula tenerrima* Locard, 1897) and distributed also in the central Atlantic. It is readily distinguished from *A. serranoi* spec. nov. by a very weak upper keel and the absence of the second abapical one and much stronger spiral elements on the subsutural ramp.

A large shell (25 mm) figured by BOUCHET AND WARÉN (1980) under the name *Ancistrosyrinx clytotropis* (Sykes, 1906) is possibly congeneric with *Aforia* and it is the known species that comes morphologically closest to the species described here, at least in the European realm. This shell comes from the northern coast of Spain (700-1120 m) and differs in being considerably stouter, with a more pronounced, protruding adapical keel and has the abapical keel marked by a duplicated cord. Sykes'

holotype collected off the West coast of Portugal ("Porcupine" Sta. 17, 39° 42′ N, 09° 43′ W, 1980 m) is considerably smaller (8 mm), but maintains the same profile as the early whorls of the shell figured by BOUCHET AND WARÉN (1980). It should be mentioned that BOUCHET AND WARÉN (1980) think that all extant material of *A. clytotropis* including the type is probably fossil.

Remarks on distribution: The present report is the first record of *Aforia* in the North Atlantic Ocean. The geographic distribution of *Aforia*, if the generic assignment of the new species is correct, is intriguing. Given that *Ancistrosyrinx clytotropis* (Sykes, 1906) is the morphologically closest species to *Aforia serranoi* spec. nov., it would turn out that morphology suggests they are congeneric.

The paucispiral protoconch of all species in this genus clearly indicates a lecithotrophic (probably entirely intracapsular) development, which would preclude long-distance pelagic dispersal in the larval stage. There are however more instances of this kind of distribution among gastropods with intracapsular development, the most noteworthy and best documented being that of a group of closely related genera of the muricid subfamily Trophoninae (HARASEWYCH, 1984).

POWELL (1951: 63-66) discussed bipolarity but pointed out that the distribution of *Aforia* achieves continuity with the presence of species such as *A. persimilis* (Dall, 1889) off the Pacific coast of Central and South America. In the Atlantic, there are no relevant data along the West African slope, but *A. serranoi* spec. nov. was found in the context of water masses flowing from the North. Taking into account that the slope fauna of the NW Atlantic is relatively well known, such a source area for this species is unlikely and therefore its occurrence off Western Europe remains unexplained and could have originated in a different paleoceanographic setting.

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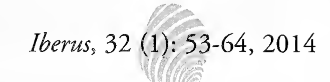
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Kaloplocamus ramosus (Cantraine, 1835) (Gastropoda: Polyceridae): new records in the Bay of Biscay, with notes on distribution and food

Kaloplocamus ramosus (Cantraine, 1835) (Gastropoda: Polyceridae): nuevos sitios en el Golfo de Vizcaya, con datos sobre su distribución y su dieta

Alex VANHAELEN*, Claude MASSIN*, Jocelyne MARTIN** and Pascal LAFFARGUE**

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ABSTRACT

Many specimens of *Kaloplocamus ramosus* (Cantraine, 1835) were collected in the Bay of Biscay during Ifremer's EVHOE scientific cruises in 2009 and 2010 (October – November). This species is new to the French Atlantic coast, which is its most northern known occurrence, and a map of its distribution in the Bay of Biscay is provided. Two prey-species (Bryozoa) were observed from gut contents. One of these, *Cellaria salicornioides,* is an addition to the known food-list of *K. ramosus.* Data on the taxonomy are given and *Doris fimbriata* delle Chiaje, 1841 is added to the synonymy of *K. ramosus.*

RÉSUMÉ

De nombreux spécimens de *Kaloplocamus ramosus* (Cantraine, 1835) ont été récoltés dans le golfe de Gascogne au cours des campagnes scientifiques Ifremer EVHOE de 2009 et 2010 (octobre – novembre). L'espèce est nouvelle pour les côtes atlantiques françaises qui représentent sa latitude la plus nordique, et une carte de sa distribution dans le Golfe de Gascogne est présentée. Deux espèces de Bryozoa ont été trouvées dans le contenu stomacal. L'une d'entre elles, *Cellaria salicornioides,* est mentionnée pour la première fois comme nourriture pour *K. ramosus.* Des informations sur la taxonomie sont fournies et *Doris fimbriata* delle Chiaje, 1841 est ajoutée à la synonymie de *K. ramosus.*

RESUMEN

Numerosos ejemplares de *Kaloplocamus ramosus* (Cantraine, 1835) fueron recogidos en el Golfo de Vizcaya durante las campañas científicas Ifremer EVHOE en 2009 y 2010 (entre octubre y noviembre). La especie es nueva para la costa Atlántica francesa, lo cual representa la cita más septentrional conocida, y se presenta un mapa de su distribución en el Golfo de Vizcaya. Dos especies-presa (Bryozoa) fueron observadas en el contenido estomacal. Una de ellas, *Cellaria salicornioides,* se añade a la lista de presas conocidas de esta especie. Se incluye un mapa de distribución en el Golfo de Vizcaya así como también datos sobre la taxonomía, añadiendo *Doris fimbriata* Delle Chiaje, 1841 a la sinonimia de *K. ramosus.*

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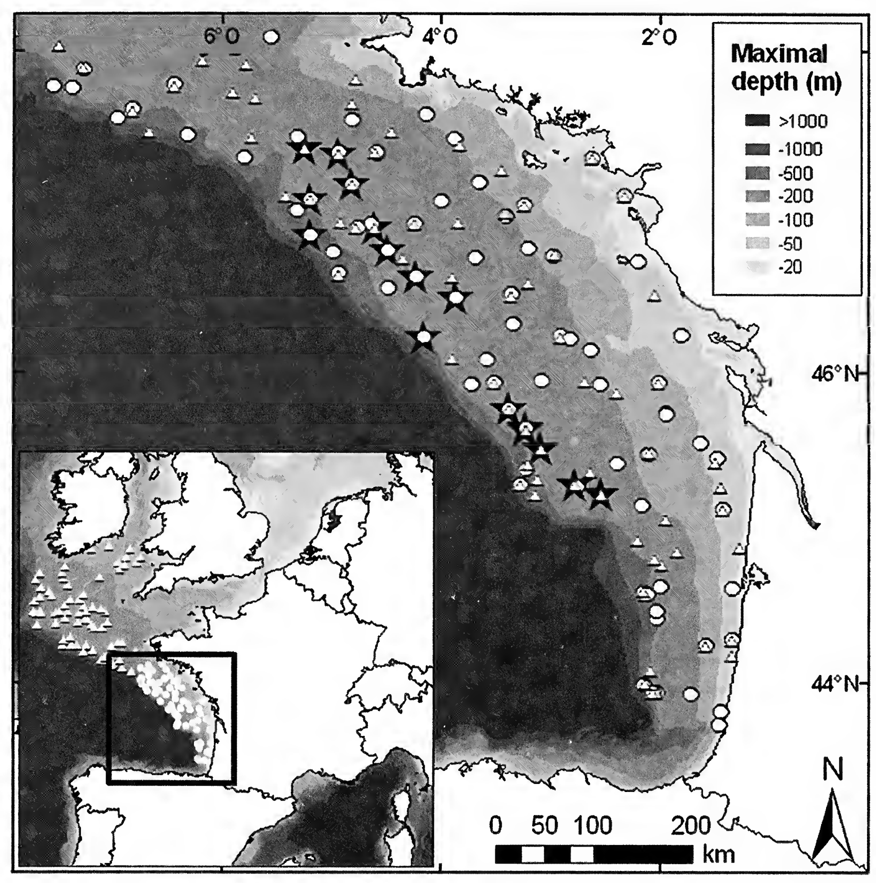


Figure 1. Map 1. EVHOE 2009-2010. Sampling area and stations. Some symbols of stations (O1016/N0817, O0991/N0779, O0992/N0780) overlap, see Table I. Stars represent localities where *Kaloplocamus ramosus* was found.

Figura 1. Mapa 1. EVHOE 2009-2010. Area y estaciones de muestreo. Algunos símbolos de estaciones (O1016/N0817, O0991/N0779, O0992/N0780) se confunden, véase la Tabla I. Las estrellas representan localidades en las que se encontró Kaloplocamus ramosus.

INTRODUCTION

Opisthobranchs are well recorded in the southern part of the Bay of Biscay (García and Bertsch 2009) as well as in the Celtic Sea and the English Channel (Hayward and Ryland 1990). However, they have been less well investigated in the northern part of the Bay of Biscay, which is the northern limit of the Lusitanian Province. During recent EVHOE (Evaluation Halieutique pour l'Ouest de l'Europe) scientific cruises in this area, whose main purpose was to assess the state of the stock of commercially valuable species (fishes, cephalopods, crustacea), numerous specimens of the opisthobranch *Kaloplocamus ramosus* (Cantraine, 1835) were collected for the first time.

K. ramosus is a widespread species, living mainly in temperate waters, but also reported in tropical waters (*e.g.* East coast of South Africa (Bergh 1907) and the Hawaiian Islands (Pittman and Fiene 2010)).

The present paper reports on geographic distribution, taxonomy, anatomy, food and habitat of *K. ramosus*.

Table I. *Kaloplocamus ramosus* (Cantraine, 1835). Sample data. All specimens collected by Jocelyne Martin and Pascal Laffargue/Ifremer, determined by Alex Vanhaelen/RBINS. Cruise ref. nbr: cruise reference number; Station ref. nbr: station reference number; Station references: N= 2009, O= 2010; qty= quantity. Total stations: 18. Total specimens: 89 (87 at RBINS, 2 at Ifremer).
Tabla I. Kaloplocamus ramosus (Cantraine, 1835). Datos de muestro. Todos los ejemplares recolectados por Jocelyne Martin y Pascal Laffargue/Ifremer, identificados por Alex Vanhaelen/RBINS. Cruise ref. nbr: número de referencia de la campaña; Station ref. nbr: número de referencia de la estación; Datos de la estación: N= 2009, O= 2010; qty= cantidad. Total de estaciones: 18. Especímenes totales: 89 (87 de RBINS, 2 de Ifremer).

RBINS INV.nbr	Cruise ref. nbr	Station ref. nbr	specim, qty	Geographic latitude	coordinates longitude	Collection dates	Depth (m)
98002	EVHOE2009	N0779	1	N 45° 38′ 20.1″	W 3° 13′ 28.7″	21-10-2009	137
98003	EVHOE2009	N0780	1	N 45° 45′ 25.2″	W 3° 23′ 13.8″	21-10-2009	150
98004\1	EVHOE2009	N0796	8	N 46° 28′ 09.7″	W 3° 51′ 23.4″	25-10-2009	142
98019	EVHOE2009	N0797	12	N 46° 12′ 23.0″	W 4° 08′ 34.7″	26-10-2009	180
98007\1	EVHOE2009	N0799	8	N 46° 36′ 05.1″	W 4° 13′ 43.9″	26-10-2009	150
98009	EVHOE2009	N0802	5	N 46° 45′ 37.3″	W 4° 28′ 47.5″	27-10-2009	148
98010	EVHOE2009	N0817	1	N 47° 10′ 27.3″	W 4° 48′ 28.2″	04-11-2009	134
Ifremer	EVHOE2009	N0817	1	N 47° 10′ 27.3″	W 4° 48′ 28.2″	04-11-2009	134
98011	EVHOE2009	N0820	1	N 46° 51′ 35.1″	W 5° 11′ 27.7″	05-11-2009	185
98012	EVHOE2009	N0822	1	N 47° 4′ 58.1″	W 5° 10′ 56.2″	05-11-2009	159
98021	EVHOE2010	O0954	15	N 45° 30′ 12.9″	W 3° 5′ 49.3″	21-10-2010	147
98022	EVHOE2010	O0961	2	N 45° 12′ 39.5″	W 2° 32′ 29.2″	22-10-2010	130
Ifremer	EVHOE2010	O0962	1	N 45° 16′ 24.0″	W 2° 46′ 18.1″	22-10-2010	133
98023	EVHOE2010	O0991	19	N 45° 37′ 27.3″	W 3° 13′ 34.9″	29-10-2010	137
98024	EVHOE2010	O0992	8	N 45° 45′ 21.6″	W 3° 23′ 13.7″	29-10-2010	149
98025	EVHOE2010	O1011	1	N 46° 54′ 14.2″	W 4° 36′ 17.4″	04-11-2010	144
98026	EVHOE2010	O1016	2	N 47° 10′ 30.2″	W 4° 48′ 25.8″	05-11-2010	131
98027	EVHOE2010	O1025	1	N 47° 22′ 3.1″	W 4° 55′ 30.3″	07-11-2010	128

MATERIALS AND METHODS

The specimens were collected at 18 stations off southern Brittany (Fig. 1, Table I) during the EVHOE surveys on board R/V *Thalassa*. During October and November of 2009 and 2010, 142 bottom trawls (stations) were performed each year.

The sampling method includes diurnal standardized 30 minutes bottom trawls at a speed of 4 knots, using a GOV-36/47 otter trawl, 20 m wide, 4 m high with a 20 mm mesh codend. This gear is not adapted to capture small benthic species (<3-4 cm) such as *K. ramosus*. Therefore the absence of this species at some stations could be an artefact. For the same reason, the population density could be underestimated.

Geographical coordinates, depths, sea water temperatures and nature of the bottom were recorded during the hauls. All data pertaining to a given station were uploaded in a database at Ifremer.

Contents of the trawl's pocket were sorted on board. Unidentified opisthobranchia were sorted, photographed when in good condition and properly labeled prior to fixation, usually in a 70% ethanol solution or deep-frozen. Specimens were sent to RBINS for identification and transfered to a 70% ethanol, borax-buffered, (pH 8.0) solution.

The radula of specimen N0799/07 was dissected, critical point dried and

gold-coated to perform SEM photographs with RBIN's FEI-QUANTA-200 ESEM (Environmental Scanning Electron Microscope) (Fig. 7).

Ten specimens (one per station, except for station O-1016) were dissected for identification of gut contents. Those stations were selected along a line joining the most southeasterly station (O-0961) to the most northwesterly station (O-1026), at the most regular possible intervals. Stations concerned were N-0796, N-0817, N-0822, O-0954, O-0961, O-0922, O-1016 (2 specimens), O-1025 and O-1026. Gut content was immersed during 10 minutes in commercial bleach, and then rinsed several times in tap water. The bryozoa were identified according to De Blauwe (2009).

Except for two specimens kept at Ifremer/Nantes (Ref. EVHOE2009-N0817/02 and EVHOE2010-O962), the collection was deposited at RBINS (general catalogue number IG-31.621) and assigned an individual Recent Invertebrates Department code number in the series INV.98.001 to INV.98.028

Two specimens from sample N0817 were photographed in a sea water filled container, alive, relaxed and extended, prior to fixation in ethanol (Fig. 2).

Photographs of preserved material were taken through the ocular of a dissecting microscope with a handheld camera.

For nomenclature we chose to follow the CLEMAM taxonomic database.

RESULTS

Class Gastropoda Cuvier, 1797

Family Polyceridae Alder & Hancock, 1845

Genus *Kaloplocamus* Bergh, 1880 [1879]

Kaloplocamus ramosus (Cantraine, 1835)

Doris ramosa Cantraine, 1835: Bull. Acad. R. Belg., 2: 383; 1841, *Nouv. Mém. Acad. R. Sci. Bruxelles*, 13: 54, pl. 3 fig. 7. [type locality: Split (as Spalato), Croatia, type specimen lost].

Euplocamus croceus Philippi, 1836, *Enum. Moll. Sicil.*, 1: 103, pl. 7 fig. 1 [Palermo (as Panormi), Italy]. —Bergh, 1880, Verh. zool.-bot. Ges. Wien, 29: 625

Euplocamus frondosus Philippi, 1839, *Arch. Naturgesch.*, 5 (1): 114, pl. 3 fig. 1 [Sicily, Italy].

Doris fimbriata delle Chiaje, 1841, *Descr. Anim. s. Vert.*, 2: 21; 5: 77; 6: pl. 44, Figs 7-10. [Napoli, Italy] — *new synonym*.

Triopa yatesi Angas, 1864, *J. Conchyl., Paris*, 12: 60, col. pl. v, Fig. 8. [Watson Bay, S.E. Australia].

Euplocamus ramosus —Bergh, 1880, *Verh. zool.-bot. Ges. Wien*, 29: 625, in synonymy of *Euplocamus croceus* Phil., erroneously credited to "Phil. Malacol. médit. 1840. p. 54. pl. 3. Fig. 7.". This is clearly confusion with Cantraine's 1841 publication, cited with a wrong date.

Euplocamus capensis; Bartsch, 1915, *Bull. U.S. natn. Mus.* 91: 239, 212.

Kaloplocamus aureus Odhner, 1932, *Ark. Zool.*, 23. A. (14): 41, fig. 11-12. [Bahía del Confital (juv.) Gran Canaria].

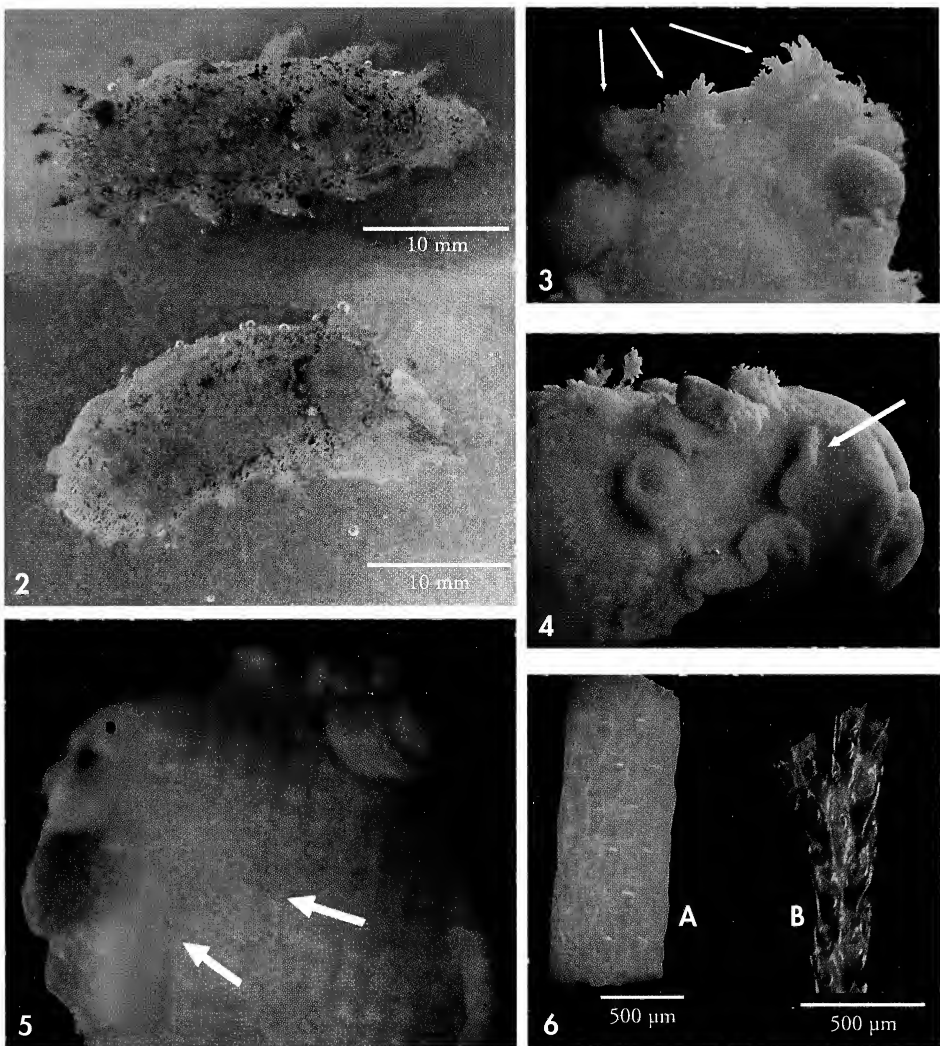
Caloplocamus ramosus —Pruvot-Fol, 1951, *Arch. Zool. exp. gén.*, 88 (1): 35, pl. 2 Figs 3, 16. [juvenile from Banyuls, France] (generic name misspelled).

Euplocamus plumosus Schultz —Pruvot-Fol, 1954, Faune Fr., 58: 323. (not *Euplocamus plumosus* W. Thompson, 1840, a junior synonym of *Limacia clavigera* (O. F. Müller, 1776)). [Sicily, Italy] (this name could not be traced elsewhere).

Kaloplocamus filosus Cattaneo-Vietti and Sordi, 1988, *Basteria*, 52: 50, fig. 1-12. [Tuscany, Italy].

Thirty nine specimens of *K. ramosus* were collected during the 2009 cruise and fifty during the 2010 cruise.

Anatomy: The body of live specimens (Fig. 2) is slug-like and about 3 times longer than broad. Extended lengths are between 29 and 33 mm. Contracted bodies measure from 16 to 28 mm long. The buccal mass is more or less evaginated in most specimens. Transversal section at mid-body is quadrangular. The sole is smooth. Anterior edge of



Figures 2-5. *Kaloplocamus ramosus.* 2: dorsal view of two living specimens relaxed in sea water (sample N0817); 3: branched processes on oral veil (arrows); 4: oral tentacle (arrow); 5: eyes on dorsum of specimen N0822 (arrows). Figure 6. Bryozoa extracted from gut of specimen N0796/08. A: *Cellaria salicornioides*; B: *Caberea boryi.*

Figuras 2-5. Kaloplocamus ramosus. *2: vista dorsal de dos ejemplares vivos relajados en agua de mar (muestro N0817); 3: papillas ramosas del velo oral (flechas); 4: tentáculo oral (flecha); 5: ojos en el dorso del espécimen N0822 (flechas). Figura 6. Briozoos extraídos del estómago del espécimen N0796/08. A:* Cellaria salicornioides, *B:* Caberea boryi.

propodium is horizontally bilamellated. No propodial tentacles are noticed. Lateral edges are thick, narrow and undulating.

In front, the oral veil is slightly rounded, with 6-7 velar processes, hereafter named 'branched processes', bearing short secondary papillae on their distal third. (Fig. 3).

The dorsum is lined by a longitudinal row of 5 similar but larger branching processes, the first in the row starting

Table II. *Kaloplocamus ramosus*. Known prey-species.
Tabla II. Kaloplocamus ramosus. *Especies de presas conocidas.*

Name in literature	Valid name according to WoRMS	Reference
Acamarchis cf. *dentata*	*Bugula neritina* (Linnaeus, 1758)	Cantraine (1841: 55)
Bugula sp.	*Bugula* Oken, 1815	Vayssière (1901: 68)
Caberea boryi	*Caberea boryi* (Audouin, 1826)	Bergh (1880: 634) [1879], this paper
Caberea sp.	*Caberea* Lamouroux, 1816	Perrone (1985: 102)
Cellaria salicornioides	*Cellaria salicornioides* Lamouroux, 1816	this paper
Cellularia scabra	? *Scrupocellaria scabra* (Van Beneden, 1848)	Bergh (1880: 634) [1879]
Porella cervicornis	*Smittina (Porella) cervicornis* (Pallas, 1766)	Perrone (1985: 102)
Retepora sp.	*Reteporella grimaldii* (Jullien, 1903)	Vayssière (1901: 68)
Scrupocellaria cf. *reptans*	*Scrupocellaria* cf. *reptans* (Linnaeus, 1758)	Cattaneo-Vietti and Sordi (1988: 51)
Scrupocellaria incurvata	*Scrupocellaria incurvata* Waters, 1897	Cattaneo-Vietti and Sordi (1988: 51)
Tubocellaria (*) *cereoides* (sic)	*Margaretta cereoides* (Ellis & Solander, 1786)	Perrone (1985: 102)

(*) error for *Tubucellaria* d'Orbigny, 1852

just behind and under the level of the rhinophores, the others on the dorsum.

A typical doridian branchial plume is present on the dorsal median, at two thirds of posterior body length.

Basic colour of head, dorsum, metapodium, stalk of rhinophores, stalk of velar and dorsal processes is creamy-yellow. Surface of dorsum and flanks can be speckled (not in all specimens) with small, randomly dispersed, whitish warts (or minute tubercles) of variable size and number.

Clavus of rhinophores is greenish-yellow, somewhat darker on one of the specimens. Branchial plume has a somewhat darker yellow tinge than the body base colour. Colour of all specimens is uniform light beige, with no pigment observed. Head, dorsum, metapodium, velar and dorsal processes are speckled with dark-reddish to brown spots in variable densities and blots.

Oral tentacle on each side of head, under oral veil, is flat, rectangular, with the two short sides somewhat rounded, and is afixed to the body wall by one of its longer sides. Ratio length to width = 2.5 to 3. (Fig. 4).

Rhinophore stalks are generally retracted in mantle pocket; clavus (lamellated cone) is protruding 50 to 100% from the dorsum and bears between 14 and 31 thin complete or partial lamellae.

The observed number of lamellae is dependent on the integrity (intact, flattened) and degree of contraction and retraction of the clavus.

One sample (N0796/07) shows a circle-shaped ripple around the rhinophore's base.

On the dorsum sides, a faint pallial ridge can sometimes be seen, starting behind the rhinophores and fading away besides the branchial plume. The first pair of the 5 dorsal branched processes is located just under and slightly behind the rhinophore basis; pairs 2 and 3 (generally the largest) stand on the pallial ridge, between the rhinophores and branchial plume; pair 4 is near the plume and pair 5 is at the rear, between the plume and metapodium.

The non-retracted branchial plume is composed of 5 tripinnate gills arranged in a horseshoe around the anal papilla.

A large genital pore is located on the right side, under and between the first and second dorsal branched processes.

Three specimens (N0796/02, N0796/03 and N0822) show a pair of tiny symmetrical dark spots embedded in the dorsal epidermis behind the rhinophores (Fig. 5).

The apparent absence of some characters (*i.e.* the absence of the minute rhinophoral sheath) can be an artefact resulting from the preserving technique.

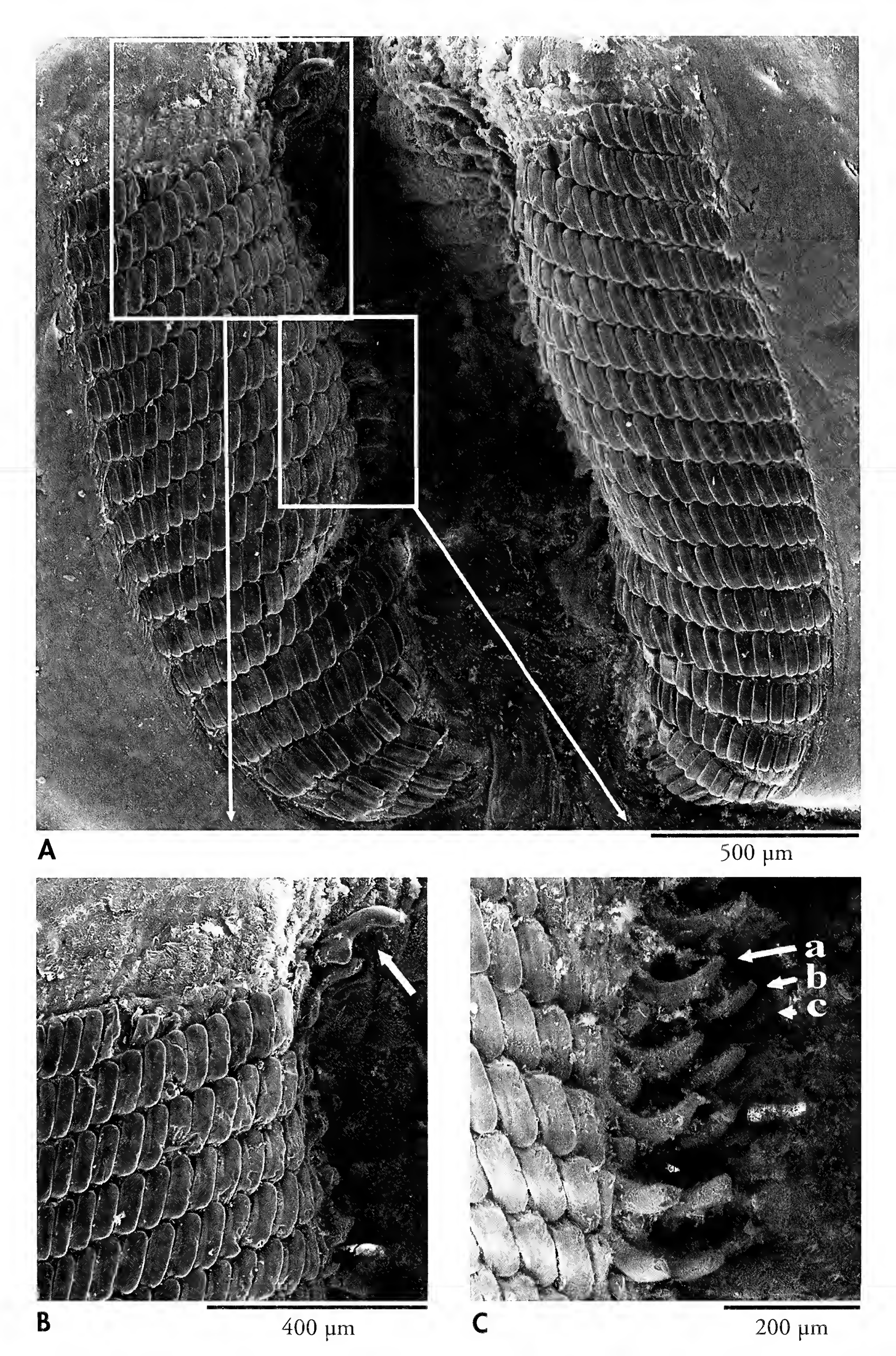


Figure 7. *Kaloplocamus ramosus.* Radula of specimen N0799/7. A: full view; B: hooked 3rd lateral tooth (arrow) and dish-like rectangular 4th to n-th lateral teeth; C: three first lateral hooked teeth (arrows a, b, c). SEM photos by J. Cellis and L. Despontin.

Figura 7. Kaloplocamus ramosus. *Rádula del espécimen N0799/7. A: vista completa; B: tercer diente lateral ganchudo (flecha) y dientes rectangulares y aplanados desde los cuartos; C: los tres primeros dientes laterales ganchudos (flechas a, b, c). Fotos al MEB por J. Cellis y L. Despontin.*

The radula (Fig. 7) presents 17 rows of denticles. In a typical row, from axis to the outer side, the center (rachis) is free of denticles; the first to 3rd lateral denticles are long, narrow hooks; the 4th to the 15,16 or 17th laterals are shallow rectangular dish-like platelets, giving the radular formula 17 x [(15-17).3.0.3. (17-15)].

Diet: Large pieces (from 1.5 to 2.2 mm long) of Bryozoa were found in the anterior part of the digestive tract of most dissected specimens (Table II).

Some specimens showed only one prey-species: *Cellaria salicornioides* Lamouroux, 1816 (in N0822, O0954, O0961 and O0922) or *Caberea boryi* (Audouin, 1826) (in O1026) (Fig. 6). One specimen (N0796) contained the two above-mentioned prey-species. The digestive tract was found empty in four of the dissected specimens.

Distribution and ecology: Sampling stations of the Bay of Biscay where *K. ramosus* specimens were collected cover an area of about 350 km long and 70 km wide, oriented along a SE-NW axis, some 120 km southwards off Brittany's south western coast, between 45° 12′ 39.5″ N – 02° 32′ 29.2″ W and 47° 23′ 51.5″ N – 05° 14′ 28.2″ W (Fig. 1 and Table I).

Collected specimens were trawled on the Bay of Biscay and Celtic Sea continental shelves from depths ranging from 128 m (station O1025) to 185 m (station N0820) on soft bottoms (ranging from sand to muddy sand) (Fig. 1). Bottom temperatures during collection ranged from 11.19 to 11.85° C. Whatever the season, mean bottom temperatures in that area are rather stable, ranging from 10.8 to 11.9° C.

DISCUSSION

Taxonomy

According to literature, *K. ramosus* has been allocated to 6 different genera (*Caloplocamus, Doris, Euplocamus, Idalia, Kaloplocamus* and *Triopa*) and cited under 14 different species names (*aureus, capensis, croceus, croceus* var. *capensis, filosus, fimbriata, frondosus, japonicus, longicornis, orientalis, plumosus, principiswalliae, tristis* and *yatesi*), indicating a highly variable species with a very large distribution area.

For an extensive review of its taxonomy, we refer to Vallès and Gosliner (2006) and Edmunds (2010).

Anatomy

General shape, body size, colour, dorsal appendages, smooth sole, number of rhinophore lamellae, 15 to 18 branched processes, oral tentacles and radula of observed specimens fit well with *K. ramosus* (see Cantraine 1835, 1841; Philippi 1836, 1844; delle Chiaje 1841; Bergh 1880 [1879], 1883, 1892, 1899; Vayssière 1901, 1913; Pruvot-Fol 1951, 1954; Macnae 1958; Schmekel and Portmann 1982; Cattaneo-Vietti and Sordi 1988; Baba 1989; Ortea-Rato, Moro-Abad and Caballer-Gutiérrez 2001 and Vallès and Gosliner 2006).

The number of pallial and velar processes might be size-dependent: Vayssière (1901) mentions 3-4 processes per side for "juveniles", 5 processes for 25-38 mm long specimens and 6 for the "largest".

Taxonomic confusion of *K. ramosus* is certainly related, at least partly, to the large variability of its colour patterns, going from creamy to brick red. However, there is apparently no relationship between colour patterns and distribution. The colour range of *K. ramosus* varies widely from translucent white with yellow-orange spots (Rudman, 2010a in Hong Kong) to pale grey with light orange-red spots (Edmunds 2010: Fig. 1-F, in Ghana) to pale yellow cream with orange variously dispersed speckles (Baba 1949: pl. XIII, Figs 46-47, in Japan) or with dark-brown speckles (our specimens in Atlantic France, Fig. 2) to almost uniform bright red with minute light yellow-orange spots (Wirtz and Debelius 2003: 214, in the Azores). No particular colour pattern seems to be locality-

dependent and different patterns are sometimes observed simultaneously at the same location.

Other *Kaloplocamus* species (*e.g. K. acutus*) also present a large colour variability with stable external morphological characters such as the branching processes (BABA 1955; BOLLAND 2006a, b and RUDMAN 2010a, b).

The two tiny dark spots embedded in the epidermis of the dorsum, behind the rhinophores, are probably rudimentary eyes. They have been mentioned by DELLE CHIAJE (1841 (2): 29) (as *Doris fimbriata)*, BERGH (1883: 142) and VAYSSIÈRE (1901: 69, pl. V, Fig. 2) and drawn by BABA (1949 pl. XIII Figs 46, 47). Several photographs of live specimens (not collected) showing the eyes can be viewed on Pitmann and Fienne's, and on Johnson's websites.

Diet

The diet of *K. ramosus* is usually broadly referred to as "bryozoans". Eight bryozoans have been identified by different authors to species level (Table II), all from the Mediterranean Sea. *Caberea boryi* (Audouin, 1826) is also found in our specimen (N0796/08). *Cellaria salicornioides* Lamouroux, 1816 is a new known prey in the diet of *K. ramosus*. Our observations and data from literature listed in Table II confirm that *K. ramosus* feeds mostly on branching Bryozoans.

The restricted number of prey-species known so far is almost certainly an artefact, being only reported from the Mediterranean Sea and the Bay of Biscay.

Distribution

K. ramosus is recorded for the first time in the Bay of Biscay. The large area where specimens were collected during the EVOHE 2009 and 2010 cruises and their large number (89) indicates that we are dealing with a well established population. The Bay of Biscay extends the distribution of *K. ramosus*, a temperate, sometimes tropical, species to its most northerly known latitude, at the northern limit of the Lusitanian Province.

According to literature and websites, the species is nearly cosmopolitan but not yet mentioned from the Americas and the Philippines.

The present worldwide distribution of *K. ramosus* and its potential taxonomic confusion (14 synonyms recognized) leads us to suspect that we are dealing either with a highly variable species or with a species complex. As already suggested by VALLÈS AND GOSLINER (2006), Rudman (several SEASLUGFORUM messages) and EDMUNDS (2010), these hypotheses should be tested via DNA analysis of material proceeding from the different areas.

Ecology

Collecting depths (128-185 m) of our material are in agreement with those reported in the literature (5-400 m) (WIRTZ 1998: 12; EDMUNDS 2010: 296; KOUTSOUBAS, TSELEPIDES AND ELEFTHERIOU 2000: 91; ZSILAVECZ 2007).

Kaloplocamus ramosus is known from soft bottoms (PRUVOT-FOL 1951; WIRZ-MANGOLD AND WYSS 1958; RÓS 1975; KOUTSOUBAS *ET AL.* 2000; DOMÈNECH, AVILA AND BALLESTEROS 2006; present study) and hard bottoms (AVÍLA, AZEVEDO, GONÇALVES, FONTES AND CARDIGOS 1998; GARCÍA-GÓMEZ 2002; CERVERA, CALADO, GAVAIA, MALAQUIAS, TEMPLADO, BALLESTEROS, GARCÍA-GOMEZ AND MEGINA 2004; MALAQUIAS, CALADO, PADULA AND CERVERA 2009; RUDMAN 2010a; BOLLAND 2006; PITTMAN AND FIENE 2010; SURG 2007; WIRTZ AND DEBELIUS 2003). This difference is mainly related to the collecting methods. Specimens collected by divers have been found on rocky bottom or wrecks, or in caves whereas dredging and bottom trawling is performed on soft bottom. The species is reported from moderately to highly exposed rocky habitats (PITTMAN AND FIENE 2010) as well as from moderate current areas (our study). *K. ramosus* is active day and night, under ledges or stones (JOHNSON 2005, WIRTZ AND DEBELIUS, 2003, PITTMAN AND FIENE 2010, MISSENDEN 2005).

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Nomenclatural notes on some European marine bivalve species

Apuntes nomenclaturales sobre algunas especies de bivalvos de Europa

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ABSTRACT

Some nomenclatural issues affecting European species are discussed. The following taxa are treated under ICZN Art. 23.9, with the required references provided:

- *Mytilus variabilis* Krauss, 1848 (currently *Brachidontes variabilis* (Krauss, 1848)) is declared *nomen protectum* against the senior homonym *Mytilus variabilis* Fischer von Waldheim, 1807, declared *nomen oblitum*. The still earlier name *Brachidontes ustulatus* (Lamarck, 1819), currently used as the valid name for a native species of Western Australia, should take precedence over *B. variabilis* (Krauss, 1848) were it demonstrated that it is the same biological species, but in the current state of knowledge it is proposed to keep them separate.
- *Modiola nigra* Gray, 1824 (currently *Musculus niger* (Gray, 1824)) is declared *nomen protectum* against the senior synonym *Mytilus discors svecicus* Fabricius, 1788, declared *nomen oblitum*.
- *Ostrea flexuosa* Poli, 1795 (currently *Flexopecten flexuosus* (Poli, 1795)) is declared *nomen protectum* against the senior synonym *Ostrea coarctata* Born, 1778, declared *nomen oblitum*.
- *Chama aculeata* Poli, 1795 (currently *Centrocardita aculeata* (Poli, 1795)) is declared *nomen protectum* against the senior homonym *Chama aculeata* Ström, 1768, declared *nomen oblitum*, thereby making valid the current usage and avoiding the need for using the junior synonym *Centrocardita elegans* (Requien, 1848).
- *Solen marginatus* Pulteney, 1799 is declared *nomen protectum* against the senior synonyms *Hypogaea tentaculata* Poli, 1791, *Solen rotundatus* Spengler, 1794 and *Solen gladius* Röding, 1798, all declared *nomina oblita*.

The following cases are discussed but do not meet the conditions for application of ICZN Art. 23.9:

- *Anadara polii* (Mayer, 1868) is in prevailing usage over *Anadara gibbosa* (Reeve, 1844) but the latter name has been employed once in the XX century so must be used.
- *Chama gryphina* Lamarck, 1819 (currently *Pseudochama gryphina* (Lamarck, 1819)), is not a junior synonym of *Chama cornuta* Dillwyn, 1817. The latter name is made an objective synonym of *Chama bicornis* Linnaeus, 1758 by lectotype designation.
- *Venus rhomboides* Pennant, 1777 (currently *Polititapes rhomboides* (Pennant, 1777)) should not be superseded by *Venus virginea* Linnaeus, 1767. The extant types of *Venus*

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virginea are here figured. Two of them belong to the species currently known as *Venerupis geographica* (Gmelin, 1791) and one to *Venerupis aurea* (Gmelin, 1791). Therefore, the suppression of the name *virginea* seems the best outcome.
- *Ensis arcuatus* (Jeffreys, 1865) and *Solen ensis major* Chenu 1843 are both held as junior synonyms of *Ensis magnus* Schumacher, 1817, therefore the name *Solen siliqua* var. *arcuata* Jeffreys, 1865 does not need to be declared *nomen protectum*.
- *Neaera bicarinata* Jeffreys, 1882 does not need to be declared a *nomen protectum* against *Neaera striata* var. *bicarinata* Jeffreys, 1876, which is a *nomen nudum*, therefore not available.

RESUMEN

Se discuten algunas cuestiones de nomenclatura que afectan a especies europeas. A los siguientes taxones se aplican las disposiciones del Art. 23.9 del CINZ, aportando las referencias requeridas:
- *Mytilus variabilis* Krauss, 1848 (actualmente *Brachidontes variabilis* (Krauss, 1848)) se declara *nomen protectum* frente al homónimo más antiguo *Mytilus variabilis* Fischer von Waldheim, 1807, declarado *nomen oblitum*. El nombre aún anterior *Brachidontes ustulatus* (Lamarck, 1819), actualmente en uso como el nombre válido para una especie de Australia Occidental, debe prevalecer sobre *B. variabilis* (Krauss, 1848) siempre que se demuestre que se trata de la misma especie biológica. En el estado actual de los conocimientos, se propone mantenerlas separadas.
- *Modiola nigra* Gray, 1824 (actualmente *Musculus niger* (Gray, 1824)) se declara *nomen protectum* frente a *Mytilus discors svecicus* Fabricius, 1788, declarado *nomen oblitum*.
- *Ostrea flexuosa* Poli, 1795 (actualmente *Flexopecten flexuosus* (Poli, 1795)) se declara *nomen protectum* frente al sinónimo más antiguo *Ostrea coarctata* Born, 1778, declarado *nomen oblitum*.
- *Chama aculeata* Poli, 1795 (actualmente *Centrocardita aculeata* (Poli, 1795)) se declara *nomen protectum* frente al homónimo más antiguo *Chama aculeata* Ström, 1768, declarado *nomen oblitum*, con lo cual se convalida el uso actual y se evita la necesidad de utilizar el sinónimo más reciente *Centrocardita elegans* (Requien, 1848).
- *Solen marginatus* Pulteney, 1799 es declarado *nomen protectum* frente a los sinónimos más antiguos *Solen rotundatus* Spengler, 1794 y *Solen gladius* Röding, 1798, todos ellos declarados *nomina oblita*.
Los siguientes casos se discuten, pero no cumplen los requisitos de aplicación del art 23.9 del CINZ:
- *Anadara polii* (Mayer, 1868) está en uso predominante sobre *Anadara gibbosa* (Reeve, 1844), pero este último nombre se ha utilizado una vez en el siglo XX y debe ser utilizado.
- *Chama gryphina* Lamarck, 1819 (actualmente *Pseudochama gryphina* (Lamarck, 1819)), no es un sinónimo más reciente de *Chama cornuta* Dillwyn, 1817. Éste último se hace sinónimo objetivo de *Chama bicornis* Linnaeus, 1758 por designación de un lectotipo.
- *Venus rhomboides* Pennant, 1777 (en la actualidad *Polititapes rhomboides* (Pennant, 1777)) no debe ser sustituido por *Venus virginea* Linnaeus, 1767. Se figuran los tipos existentes de *Venus virginea*. Dos de ellos pertenecen a la especie actualmente conocida como *Venerupis geographica* (Gmelin, 1791) y uno es *Venerupis aurea* (Gmelin, 1791). Por lo tanto, la supresión del nombre *virginea* parece lo más apropiado.
- *Ensis arcuatus* (Jeffreys, 1865) y *Solen ensis major* Chenu 1843 se consideran como sinónimos más recientes de *Ensis magnus* Schumacher, 1817. Por lo tanto, no es necesaria la declaración de *Solen siliqua* var. *arcuata* Jeffreys, 1865 como *nomen protectum*.
- *Neaera bicarinata* Jeffreys, 1882 no necesita ser declarado *nomen protectum* frente a *Neaera striata* var. *bicarinata* Jeffreys, 1876, que es un *nomen nudum*, por lo tanto, no está disponible.

INTRODUCTION

The rules of zoological nomenclature regarding priority and homonymy are intended for preserving the stability of names, and in most cases are instrumental in doing so. There are nevertheless some instances where undesirable changes may be mandatory when overlooked senior synonyms or homonyms are brought to attention. Digging out forgotten names was legitimate under the previous editions of the Code, and one of the most troublesome cases in the European marine fauna has been the revival of limpet names *Patella nigra, P. ulyssiponensis* and *P. rustica* against respectively *Patella safiana, P. aspera* and *P.lusitanica* all universally in usage at that time (Christiaens, 1973). Fortunately, the 1999 edition of the Code (ICZN, 1999, Art. 23.9) has provisions for the conservation of usage when certain conditions are met.

The recent publication of the "Compendium of Bivalves" (Huber, 2010) has been a landmark in malacology, and provides for the first time a global overview of species-level taxonomy in this class. Precisely because it is comprehensive, it is also influential and, for instance, has been taken as the default standard in the World Register of Marine Species, the leading database for marine biodiversity data. Some changes in nomenclature are suggested therein on the grounds that earlier names which interfere as synonyms or homonyms have been overlooked so far and should be used.

The purpose of this paper is to document the usage which can lead to the application of Art. 23.9, and to discuss some additional cases for which, although the requirements of this article are not met, a conservative treatment is considered desirable for the stability of nomenclature. Marshall & Spencer (2013), in a similar approach, discussed the nomenclatural changes which are derived from Huber (2010) affecting the New Zealand fauna and propose the rebuttal of some of them, but without declaring any *nomen oblitum* or *nomen protectum*. Huber (2010) declared eight names as *nomina protecta* and their senior synonyms or homonyms *nomina oblita* but these actions are invalid because they lack citation of the references of usage required by ICZN Art. 23.9; three of these (*Solen arcuatus* Jeffreys, 1865, *Chama gryphina* Lamarck, 1819 and *Cuspidaria bicarinata* Jeffreys, 1882) regard the European fauna and will be discussed herein.

Literature was searched for possible instances of usage using both the Zoological Record and the advanced search function of Google Books <http://books.google.com/> and Google Scholar <http://scholar.google.com/>, eventually checked against the originals (digital or paper). We have strived to include references from different fields, including palaeontology or archaeology, fisheries, environmental studies as well as checklists or taxonomic papers.

We have made the option to ignore the usage by authors after 2000, including Huber (2010) for the names to be dismissed, as the Code reads (our italics) "23.9.2. An author who discovers that both the conditions of 23.9.1 are met *should* cite the two names together and state explicitly that the younger name is valid...". This interpretation is supported by ICZN Art. 23.9.6. which reads "The deliberate use of a name contrary to Article 23.9.1 (...) must not be taken into account in determining usage".

We have systematically reported the cases in which species considered here are the type of a genus-group name. This is not formally an argument in favour of conserving names but still makes it desirable whenever possible.

Article 23.9 of ICZN is here reproduced for guidance:

23.9.1. prevailing usage must be maintained when the following conditions are both met:

23.9.1.1. the senior synonym or homonym has not been used as a valid name after 1899, and

23.9.1.2. the junior synonym or homonym has been used for a particular taxon, as its presumed valid name, in at least 25 works, published by at least 10 authors in the immediately preceding 50 years and encompassing a span of not less than 10 years.[i.e. 1963-2012]

23.9.2. An author who discovers that both the conditions of 23.9.1 are met should cite the two names together and state explicitly that the younger name is valid, and that the action is taken in accordance with this Article; at the same time the author must give evidence that the conditions of Article 23.9.1.2 are met, and also state that, to his or her knowledge, the condition in Article 23.9.1.1 applies. From the date of publication of that act the younger name has precedence over the older name. When cited, the younger but valid name may be qualified by the term nomen protectum and the invalid, but older, name by the term nomen oblitum. In the case of subjective synonymy, whenever the names are not regarded as synonyms the older name may be used as valid.

CASES TREATED UNDER ICZN ART. 23.9

Brachidontes variabilis (Krauss, 1848) vs. *Brachidontes pharaonis* (Fischer, 1870) and *Brachidontes ustulatus* (Lamarck, 1819)

Names involved:
Mytilus variabilis Fischer von Waldheim, 1807, *Muséum Demidoff*, vol. 3: 249.
Mytilus variabilis Krauss, 1848, *Die Südafrikanischen Mollusken*: 25-26, pl. 2 fig. 5.
Mytilus ustulatus Lamarck, 1819, *Histoire naturelle des animaux sans vertèbres*, vol. 6 (1): 122.
Mytilus pharaonis P. Fischer, 1870, *Journal de Conchyliologie*, 18: 169.

A small mytilid species was known from South Africa and also reported as an invader in the Mediterranean Sea under the name *Brachidontes variabilis* (Krauss, 1848) until the mid 1990's, when it was realized that this is a primary homonym of *Mytilus variabilis* Fischer von Waldheim, 1807. Under the current code, Art. 23.9 applies since Fischer von Waldheim's name (currently treated as a junior synonym of *Mytilus edulis* Linnaeus, 1758) has never been used otherwise than in synonymy. The name *variabilis* was dismissed in DEKKER & ORLIN'S (2000) check-list and since then, the junior name *B. pharaonis* (Fischer, 1870) is treated as synonym and is universally used in the Red Sea and Mediterranean realm (ENGL, 1995; BUZZURRO & GREPPI, 1996 and most later authors). However HUBER (2010) proposed to use for this species a still earlier name *Brachidontes ustulatus* (Lamarck, 1819) originally described from "Brazil".

Huber writes "Lamy (1936) (...) considered *M. pharaonis* from the Red Sea, Suez and *arabicus* the same. Furthermore, Lamy analysed Lamarck's MNHN type series of *M. ustulatus*, described from Brazil and noted it identical to *variabilis = arabicus= pharaonis*." Nevertheless, knowing this, Lamy still used *B. variabilis* as the valid name for this taxon. There is concurrently a consistent usage of *Brachidontes ustulatus* (Lamarck, 1819) as the valid name of a taxon in Western Australia (BINDON, DORTCH & KENDRICK, 1978; JONES, 2004; PLATELL, ANG, HESP & POTTER, 2007; SCOTT & JOHNSON, 1993; SEMENIUK, 1997; WELLS & BRYCE, 1984; WILSON, 1998 among others) and therefore the question of conserving the name *M. variabilis* is a taxonomic, not nomenclatural issue. The Brazilian type locality is evidently wrong, as no candidate species is reported there; many of the Baudin expedition types are from King George Sound, Western Australia, and that is probably where *B. ustulatus* came from (F. Wells, pers. comm.).

A recent molecular study (SIRNA TERRANOVA, LO BRUTTO, ARCULEO & MITTON, 2007) reveals that the Red Sea and Mediterranean populations, the East African populations and a population from Hong Kong represent three cryptic

species. This implies separating the Red Sea *B. pharaonis* from the East African *B. variabilis* and using both names as valid. The final decision on giving the name *B. ustulatus* (Lamarck, 1819) precedence over *B. variabilis* (Krauss, 1848) depends on whether the Western Australian species is the same as that living in the eastern African coast.

In order to conserve both names potentially valid, we hereby declare, according to the provisions of ICZN Art. 23.9.2 the name *Mytilus variabilis* Krauss, 1848 as *nomen protectum*, and *Mytilus variabilis* Fischer von Waldheim, 1807, as *nomen oblitum*. Usage of *Brachidontes variabilis* (Krauss, 1848) as a valid name has been found in the following sources: ARCIDIACONO & DI GERONIMO, 1976; ATAPATTU, 1972; BARNARD, 1964 (p. 395); BARASH & DANIN, 1992 (p. 333-334); BIGGS, 1973 (p. 382); BRITTON, 1990 (p. 816-817); CHEUNG, LUK & SHIN, 2006; DAVIES, 1980; FELSENBURG & SAFRIEL, 1974; LAVEE & RITTE, 1994; LEE & MORTON, 1985; MORTON, 1988; OLIVER, 1992 (p. 48, 224); NAKHLÉ, COSSA, KHALAF & BELIAEFF, 2006; PARENZAN, 1974 (p. 59); PLAZIAT, BALTZER, CHOUKRI, CONCHON, FREYTET, ORSZAG-SPERBER, RAGUIDEAU & REYSS, 1998 (p. 551); RAJAGOPAL, VENUGOPALAN, VAN DER VELDE & JENNER, 2005; SAFRIEL, FELSENBURG & GILBOA. 1980; SAFRIEL, GILBOA & FELSENBURG, 1980; SAFRIEL & SASSON-FROSTIG, 1988; SIRNA TERRANOVA ET AL., 2007; SLOAN, 1979; STERN & ACHITUV, 1978; TANG. 1992; TRINGALI & VILLA, 1989 (p. 35); ÜNSAL, 1984; VALENTICH-SCOTT, 2003 (p. 265, with additional references cited therein); VAN AARTSEN & KINZELBACH, 1990.

Musculus niger (J.E. Gray, 1824) vs. *Musculus svecicus* (Fabricius, 1788)

Names involved:

Mytilus discors Linnaeus — β *svecicus* Fabricius, 1788, *Nye Samling af det Kongelige Danske Videnskabers Selskabs Skrifter*, 3: 460.

Modiola nigra Gray, 1824, *Supplement to Appendix, Parry's Voyage for the Discovery of a north-west passage in the years 1819-1820*, p. ccxliv.

This is a common boreal species, widely distributed in the North Atlantic, Arctic and North Pacific oceans, and of importance in trophic webs. FABRICIUS (1788) introduced the name in the form *Mytilus discors*, L. — β *svecicus*, based on figures 766-767 of CHEMNITZ, 1785 (vol. 8, p. 191-195, pl. 86 fig. 766-767, with type locality in the Kattegat); he did not use the term "variety" and a subspecies concept was not elaborated at that time, but it is clear that the name is available with a subspecific rank in the sense of ICZN. *Modiola nigra* Gray, 1824 is based on the figure given by MONTAGU (1808: pl. 26 fig. 4) of a specimen from Laskey, collected in the Frith of Forth (Scotland) and wrongly assigned to his *Mytilus discrepans* Montagu, 1803. The name has consistently been applied since its publication and is widely used in modern literature. In the XX century, to our knowledge only DAUTZENBERG & FISCHER (1912), and LAMY (1937) mentioned the name *svecicus* but nevertheless used *Modiolaria nigra* or *Musculus niger*, as valid. In application of ICZN Art. 23.9.2, we declare the name *Mytilus discors svecicus* Fabricius, 1788 as a *nomen oblitum*, and *Modiola nigra* Gray, 1824, a *nomen protectum*. Usage of the name *Musculus niger* as valid was documented in the following sources: AITKEN & GILBERT, 1996; BAHR & GULLIKSEN, 2001; CHAMBERS, 2009 (p. 131); DENISENKO, RACHOR & DENISENKO, 2003; FENCHEL, 1964; GILBERT, 1977; JEWETT & FEDER, 1980; KENDALL, 1996.; K DRA, GROMISZ, JASKUŁA, LEGE Y SKA, MACIEJEWSKA, MALEC, OPANOWSKI, OSTROWSKA, WŁODARSKA-KOWALCZUK & W SŁAWSKI, 2010; KRÖNCKE, 1994; LANDE, 1975; LARSEN, FRISCHER, RASMUSSEN & HANSEN, 2005; MCCORMICK-RAY, WARWICK & RAY, 2011; MØHLENBERG & RIISGÅRD, 1978; MUUS, 1973; NORDSIECK,

1969 (p. 36); NORTON, 1975; POLLOCK, 1998 (p. 157); RÓZYCKI, 1992; SCHIØTTE, 1989; SIFERD & WELCH, 1992; STRAND, JACOBSEN, PEDERSEN & GRANMO, 2003; TANDBERG, SCHANDER & PLEIJEL, 2010; TEBBLE, 1966 (p. 47).; TYLER, 1972; VADER & BEEHLER, 1983; WAGNER, 1977; WILDISH & PEER, 1983.

Flexopecten flexuosus (Poli, 1795) vs. *Flexopecten coarctatus* (Born, 1778)

Names involved
Ostrea coarctata Born, 1778, *Index Rerum Naturalium Musei Caesarei Vindobonensis*, 1: 90-91.
Ostrea flexuosa Poli, 1795, *Testacea Utriusque Siciliae*, vol. 2: 161, pl. 28 fig. 11.

Flexopecten flexuosus is a common species found in the Mediterranean and the Atlantic Ibero Moroccan area. *Ostrea flexuosa* Poli, 1795 is the type species of *Flexopecten* Sacco, 1897 by original designation. To our knowledge, the name *coarctatus* was used (in the original combination *Ostrea coarctata*) by Brocchi, 1814 (574, pl. 14 fig. 9) and later cited under the combination *Pecten coarctatus* by DEFRANCE (1824) but, possibly because of the influence of SACCO's (1897) monograph, we could not trace any usage as the valid name in the XX century. Usage of *flexuosus* is widespread and we therefore consider that the conditions are met for application of ICZN Art. 23.9.2 and declare the name *Ostrea flexuosa* Poli, 1791 as *nomen protectum*, and *Ostrea coarctata* Born, 1778, *nomen oblitum*. DIJKSTRA (2009) already proposed this but did not provide the references required by the Code.

Usage as valid name in the combination *Flexopecten flexuosus* (unless otherwise noted) was found in the following sources: BIAGI & CORSELLI, 1978 (p. 11); DIJKSTRA & GOUD, 2002 (p. 60-61); DIJKSTRA, 2009 (p. 105, 110-111); GIANNUZZI-SAVELLI, PUSATERI, PALMERI, EBREO, COPPINI, MARGELLI & BOGI, 2001 (p. 182-183); GIRIBET & PEÑAS, 1997 (p. 57); GOFAS, 2011a (p. 578); MARGUS, 1991; NORDSIECK, 1969 (p. 53); ÖZTÜRK, BUZURRO & BENLI, 2003 (p. 64); PARENZAN, 1974 (p. 112-113); PEÑA, CANALES, ADSUARA & SOS, 1996; RICO-GARCÍA, 1988 (p. 113); ROLÁN, 2011 (p. 323); ROMBOUTS, COOMANS & VAN PEL, 1991 (p. 40); RUEDA, SALAS & GOFAS, 2000 (p. 104); SCHIAPARELLI, 2008; in the combination *Chlamys flexuosa* or *Chlamys (Flexopecten) flexuosa*: CACHIA, MIFSUD & SAMMUT, 2004 (p. 54); D'ANGELO & GARGIULLO, 1978 (p. 178); LUCAS, 1980 (p. 164); MONTERO AGÜERA, 1971 (p. 171); POPPE & GOTO, 1993 (p. 61); PELORCE, 2007 (p. 47); PÉRÈS & PICARD, 1964 (p. 85, 87); SALAS, 1996 (p. 55); ŠILETI , 2006; ZENETOS, 1997 (p. 464).

Centrocardita aculeata (Poli, 1795) vs. *Centrocardita elegans* (Requien, 1848)

Names involved
Chama aculeata Poli, 1795: *Testacea Utriusque Siciliae*, vol. 2: 122, pl. 23 fig. 22.
Chama aculeata Ström, 1768: *Det Kongelige Norske Videnskabers Selskabs Skrifter*, 4: 368, pl. 16 fig. 4.
Cardita elegans Requien, 1848: *Catalogue des coquilles de l'île de Corse*: 27.

Chama aculeata Poli, 1795 is the type species of genus *Centrocardita* Sacco, 1899. The name has been displaced for being a primary homonym of *Chama aculeata* Ström, 1768 (synonym of *Hiatella arctica*) which has never, to our knowledge, been used later as the valid name of a taxon. We therefore consider that the conditions are met for application of ICZN Art. 23.9.2 and declare the name *Chama aculeata* Poli, 1795 as *nomen protectum*, and *Chama aculeata* Ström, 1768, *nomen oblitum*. With this statement, *Cardita elegans* Requien, 1848 is to be treated as a subjective junior synonym of *Centrocardita aculeata* (Poli, 1795).

There is a limited usage of the name *elegans* (in the combination *Glans elegans*) in the recent literature (CACHIA, MIFSUD & SAMMUT, 1993: 59; CACHIA, 1999; ÖZTÜRK *ET AL.*, 2003: 65; REPETTO, ORLANDO & ARDUINO, 2005; CACHIA, MIFSUD & SAMMUT, 2004: 87) but this does not interfere with restoring *C. aculeata*, because the name declared as *nomen oblitum* is the senior homonym of *C. aculeata* (Poli, 1795), not the senior synonym *Cardita elegans*.

Usage of the name *aculeata* (in the combination *Glans aculeata* unless otherwise stated) has been found in the following sources: ALBAYRAK, BALKIS & BALKIS, 2004; ALTIMIRA, 1977 (as *Cardita (Glans) aculeata*); BAKIR, ÖZTÜRK, DO AN & ÖNEN, 2012; BERNASCONI & STANLEY, 1997; BORG, HOWEGE, LANFRANCO, MICALLEF, MIFSUD & SCHEMBRI, 1998 (p. 19); DHORA, 2009; GIRIBET & PEÑAS, 1997 (p. 58); GOFAS, 2011b (p. 595); KOULOURI, DOUNAS, ARVANITIDIS, KOUTSOUBAS & ELEFTHERIOU, 2006; LA PORTA, TARGUSI, LATTANZI, LA VALLE, PAGANELLI & NICOLETTI, 2009; MALAQUIAS, BENTES, ERZINI & BORGES, 2006; MANOUSIS, MPARDAKIS, PARASKEVOPOULOS & GALINOU-MITSOUDI, 2010 (p. 166); MARASTI, 1973 (p. 106-107, as *Glans (Centrocardita) aculeata*); MECO CABRERA, 1982 (p. 102, as *Cardita aculeata*); MONTERO AGÜERA, 1971 (p. 155, as *Beguina (Mytilicardita) aculeata*); NORDSIECK, 1969 (p. 74, as *Cardita (Glans) aculeata*); PANCUCCI-PAPADOPOULOU, SIMBOURA, ZENETOS, THESSALOU-LEGAKI & NICOLAIDOU, 1999; PARENZAN, 1974 (p. 153, as *Cardita aculeata*); PÉRÈS & PICARD, 1964 (p. 94, as *Cardita aculeata*); SALAS, 1996 (p. 62); SCHIAPARELLI, 2008; ŠILETI , 2006 (p. 143); TORNARITIS, 1987 (p. 147, as *Cardita aculeata*); TRAPANI, SCOTTI, GIANGUZZA, CHEMELLO & RIGGIO, 1999; ZENETOS, 1996 (p. 125); ZENETOS, 1997 (as *Glans (Centrocardita) aculeata*).

Solen marginatus Pulteney, 1799 vs. *Solen rotundatus* Spengler, 1794, *Solen gladius* Röding, 1798 and *Hypogaea tentaculata* Poli, 1791

Names involved:

Solen marginatus Pulteney, 1799, *Catalogue of the birds, shells, and some of the more rare plants of Dorsetshire*: 28.

Hypogaea tentaculata Poli, 1791, Testacea Utriusque Siciliae, vol. 1: 16-17.

Solen rotundatus Spengler, 1784, *Skrivter af Naturhistorie-Selskabet*, Kiøbenhavn, 3 (2): 86-87.

Solen gladius Röding, 1798, *Museum Boltenianum*: 154.

The sole European representative of the family Solenidae has been alternatively known under the names *Solen vagina* Linnaeus, 1758 or *Solen marginatus* Pulteney, 1799. The former name has been often used in the XIX century but is now abandoned in the European literature for taxonomic reasons. It has been established that Linnaeus confused two different species under the name *vagina*, which should apply to the Indo-Pacific species, rather than to the European *Solen marginatus* Pulteney, 1799.

BUCQUOY, DAUTZENBERG & DOLLFUS (1895: 498) give a complete listing of XIX century usage.

There are however three other names which predate *Solen marginatus* and have a European type locality. *Solen rotundatus* Spengler, 1794 is based on LISTER (1692, pl. 1056, fig. 5) and is stated as Mediterranean. It was listed by MÖRCH (1871) as being *Solen vagina* as understood at that time. Otherwise than through the statement of origin, Lister's figure could not be definitely assigned to one of the species involved. The name had definitely fallen into oblivion when HUBER (2010) proposed that it should supersede *S. marginatus*. *Solen gladius* Röding, 1798 is based on CHEMNITZ (1782, vol. 6, pl. 4 fig. 27) with *Solen vagina* given in synonymy and, to our knowledge, has never been used later as a valid name.

POLI (1791) used for this species the name *Solen vagina*, as usual in his time,

but, in his rather queer system of parallel nomenclature for the soft parts and the shells, named these soft parts *Hypogaea tentaculata*. Such names are here treated as names introduced in synonymy, and therefore not available if never used as valid which is the case here (cited by NORDSIECK, 1969: 145, in synonymy of *Solen marginatus*). The cardiid genus *Cerastoderma*, which was introduced in the same conditions, is widely used nowadays as valid.

An additional reason for preserving the stability of the name *Solen marginatus* is that this name is used in local fisheries regulations (e.g. MINISTÉRIOS DA DEFESA NACIONAL, DAS FINANÇAS, DA JUSTIÇA, DA AGRICULTURA, PESCAS E ALIMENTAÇÃO, DAS OBRAS PÚBLICAS, TRANSPORTES E COMUNICAÇÕES, DA SAÚDE E DO COMÉRCIO E TURISMO, 1989; CONSEJERÍA DE AGRICULTURA Y PESCA, 2009; CONSELLERÍA DEL MEDIO RURAL Y DEL MAR, 2012). Therefore, the name *Solen marginatus* Pulteney, 1799 is declared *nomen protectum* against *Solen rotundatus* Spengler, 1794, *Solen gladius* Röding, 1798 and *Hypogaea tentaculata* Poli, 1791, all declared *nomina oblita*.

Usage of *Solen marginatus* as a valid name was found in the following sources: BAKIR *ET AL.*, 2012 (p. 180); CACHIA, MIFSUD & SAMMUT, 2004 (p. 105); COSEL, 1993; DA COSTA & MARTÍNEZ-PATIÑO, 2009; EALES, 196 (p. 164); FERNÁNDEZ-TAJES & MÉNDEZ, 2007; GIRIBET & PEÑAS, 1997 (p. 59); GUTIÉRREZ ZUGASTI, 2010 (p. 341); HAYWARD & RYLAND, 1995 (p. 616); HODGSON,1984; LÓPEZ, RODRÍGUEZ & CARRASCO, 2005,; LÓPEZ-FLORES, GARRIDO-RAMOS, DE LA HERRAN, RUIZ-REJÓN, RUIZ-REJÓN & NAVAS, 2008; MANOUSIS *ET AL.*, 2010. (p. 167); MARINA & URRA, 2011 (p. 690); MEIJER, 1993; MONTERO AGÜERA, 1971 (p. 224); NORDSIECK, 1969 (p. 145, erroneously credited to PENNANT, 1777); ÖZTÜRK,BUZURRO & BENLI, 2003 (p. 65); PARENZAN, 1974 (p. 364); PÉRÈS & PICARD, 1964 (p. 58, 113); REMACHA-TRIVIÑO, 2005; RIEDL, 1983 (p. 372); SCHIAPARELL, 2008; TIRADO, RODRÍGUEZ, BRUZÓN, LÓPEZ, SALAS & MÁRQUEZ, 2002; VALE & SAMPAYO, 2002.; ZENETOS, 1996 (p. 125); ZENETOS, 1997 (p. 466).

CASES WHICH CANNOT BE TREATED UNDER ART. 23.9 OF ICZN

Anadara gibbosa (Reeve, 1844) vs. *Anadara polii* (Mayer, 1868)

This is a moderately common species occurring on the outer shelf of the Mediterranean and the Eastern Atlantic from the Iberian Peninsula to Angola. Until the mid 1990s, most authors (e.g. NORDSIECK, 1969; PARENZAN, 1974; POPPE & GOTO, 1993) misidentified this species as *Anadara diluvii* (Lamarck, 1805) and therefore did not use the specific name *polii*. This usage persisted even later (e.g. ZENETOS, 1997; GIRIBET & PEÑAS, 1997), although it is now widely accepted (OLIVER & COSEL, 1993; HUBER, 2010) that *A. diluvii* is a different, extinct species with a type locality in the Miocene of the Loire basin, France (and type species of *Diluvarca* Woodring, 1925 by original designation).

Arca gibbosa Reeve, 1844 was described from unknown locality and appears to be a senior synonym of *Arca polii* Mayer, 1868. There is one syntype (reg. nº 1969216) in The Natural History Museum, London, recorded by STEVENSON (1972) who did not, however, relate it to *Anadara polii*.

There is unfortunately one instance of a usage of the specific name *gibbosa* Reeve in the XX century (VAN BEEK, 1969), within an archaeological publication regarding South Arabia. The figures given (his pl. 56a) would fit *Anadara natalensis* (Krauss, 1848), a well-known species ranging from the Red Sea and Persian Gulf to South Africa and introduced in the Eastern Mediterranean, rather than *Anadara polii*. Albeit a misidentification, it remains that for nomenclatural purposes it precludes the application of ICZN Art. 23.9. We could

document the 25 usages of the epithet *polii*, but hardly any more, so that it is not realistic to make a case for requesting the suppression of *gibbosa*. Therefore, we endorse HUBER's (2010) view of using *Anadara gibbosa*.

Arca gibbosa Reeve, 1844 is a senior homonym of *Arca gibbosa* d'Orbigny, 1845 (Paléontologie Française, Crétacé III, p. 224, pl. 316 fig. 5-8), a Mesozoic fossil species for which NYST (1848) coined the replacement name *Arca sarthacensis*.

Chama cornuta Dillwyn, 1817 vs. *Chama bicornis* Linnaeus, 1758 or *Chama gryphina* Lamarck, 1819 (Figure 1)

Names involved:
Chama bicornis Linnaeus, 1758, *Systema Naturae*, ed. 10: 692.
Chama cornuta Chemnitz, 1784, *Systematisches conchylien-Cabinet*, vol. 7: 150, pl. 52 fig. 516-520 (unavailable nomenclaturally: ICZN Direction 1).
Chama cornuta Dillwyn, 1817, *A descriptive catalogue of Recent shells*: 222.
Chama gryphina Lamarck, 1819, *Histoire naturelle des animaux sans vertèbres*, vol. 6 (1): 97.

The well-known name *Chama gryphina* Lamarck, 1819, currently *Pseudochama gryphina* (Lamarck, 1819), has been declared, by HUBER (2010), *nomen protectum* against *Chama cornuta* Dillwyn, 1817. However this action was backed by references cited by LAMY (1928) whereas Art. 23.9.2 requires references spanning not less than ten years in the immediately preceding 50 years (i.e. since 1963), therefore it is invalid.

Consultation of the original references involved revealed a much more complex issue, rendering pointless the citation of 25 usages of the name *gryphina* which we could easily find. The name *Chama cornuta* Dillwyn, 1817 is based on a suite of references among which *Chama cornuta* Chemnitz, 1784 (non-binominal, therefore unavailable) and *Chama bicornis* Linnaeus, 1758. The species is stated as inhabiting the Mediterranean, reproducing LINNAEUS' (1758) indication for *Chama bicornis*. Chemnitz's original figures show chamids, some of which stated as collected in the Indian Ocean, and all of which have an upper valve coiling counterclockwise. Therefore Chemnitz's specimens are real *Chama*, not *Pseudochama*, and *Chama cornuta*, if based on those figures, cannot be a senior synonym of *Pseudochama gryphina* (Lamarck, 1819).

Although not formally a replacement name, the epithet *cornuta* is meant by DILLWYN (1817) to stand in place of *bicornis*, considered improper because only one valve, not both, have horn-like projections. Both names are based on shared cited references (see below), so that we consider appropriate to treat *Chama cornuta* Dillwyn, 1817 as an objective synonym of *Chama bicornis* Linnaeus, 1758.

Chama bicornis Linnaeus, 1758 is itself a problematic taxon. It is based on three references to pre-Linnean authors: Caput 19 [pp. 29-30] of FABIUS COLUMNA (1616); pl. 214 fig. 49 of LISTER (1687) and p. 174 [misquoted "274" in Linnaeus, 1758], pl. 12 fig. 87-88 of KLEIN (1753), the two latter being copied from COLUMNA (1616). All these references are repeated by DILLWYN (1817) in addition to the reference to *Chama bicornis* Linnaeus, 1758. In order to make the two names formally objective synonyms, the specimen figured by COLUMNA (1616) is here designated as lectotype of *Chama bicornis* Linnaeus, 1758 and of *Chama cornuta* Dillwyn, 1817. The specimens labelled *Chama bicornis* in the Linnean collection in London are believed to be subsequent (HANLEY, 1850: 90; DODGE, 1952: 139) and the latter author advocated the suppression of the name. There are no registered specimens of *Chama bicornis* in Uppsala (WALLIN, 2001). The fact that Linnaeus coined the name "*bicornis*" on the assumption that COLUMNA (1616)

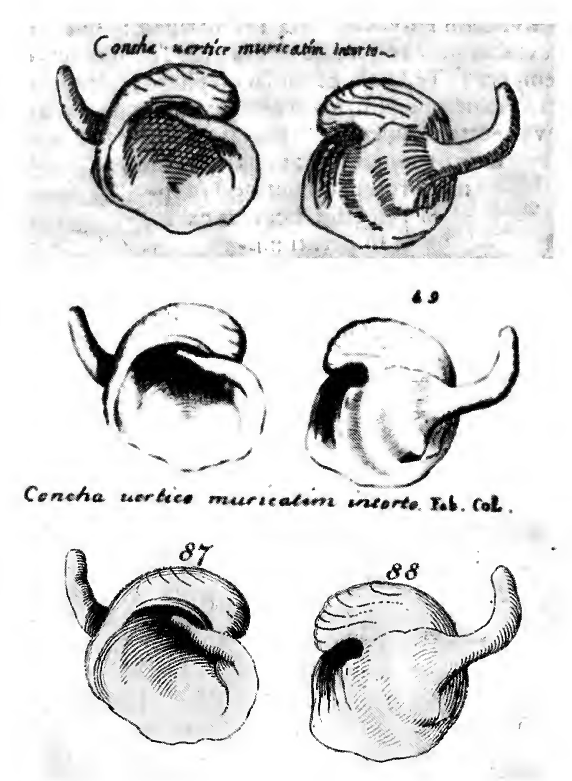


Figure 1. The three figures cited by Linnaeus (1758) in support of his *Chama bicornis*. Above, in Fabius Columna (1616, caput 19, page 30, lower figure unnumbered); middle, in Lister (1687, pl. 214 fig. 49); lower, in Klein (1753: pl. 12 fig. 87-88) (upper two figures, downloaded from Google Books; lower figure from Biodiversity Heritage Library).

Figura 1. Las tres figuras citadas por Linneo (1758), en apoyo de su Chama bicornis. *Arriba, en Fabius Columna (1616, caput 19, página 30, figura inferior sin numerar), en medio, en Lister (1687, pl 214 Fig. 49); abajo, en Klein (1753: pl 12 fig 87-88) (dos figuras superiores, descargados de Google Books, la de abajo desde Biodiversity Heritage Library).*

figured both valves and not the inside and outside of the same valve (see Dollfus & Dautzenberg, 1932: 302) is a good indication that he had only that figure as a source.

The specimen figured by Fabius Columna is a real *Chama*, not *Pseudochama*, according to the coiling direction, and the figures in this book are not "mirror image" of the original, as happened in several XVII century books due to the process of engraving. The protruding item is stated as being a branch of red coral, not part of the shell itself. This supports strongly Linnaeus' indication of a Mediterranean origin, and suggests that the specimen was collected in rather deep water. This fits the view expressed by Pallary (1919), Dautzenberg (1927) and Dollfus and Dautzenberg (1932) that *Chama bicornis* is an earlier name for the Mediterranean *Chama circinata* Monterosato, 1884 = *C. nicolloni* Dautzenberg, 1892. Dollfus & Dautzenberg (1932) nevertheless refrained from adopting the name *bicornis* as valid, due to the confusion around it.

The name *Chama bicornis* cannot be declared *nomen oblitum* because it has been used as the valid name of a taxon by Dautzenberg (1927: 304) as a senior synonym of his own *Chama nicolloni*,

and again by NORDSIECK (1969: 96, authorship erroneously credited to GMELIN, 1790) in an identification guide. The latter usage was followed by EINSELE, ELOUARD, HERM, KÖGLER & SCHWARZ (1977: 11) for West Africa and ZENETOS (1996) for Greece. The outcome is that the name is available, and in the current stage of knowledge, either it should be used as a senior name for the circalittoral Mediterranean species currently known as *Chama circinata* Monterosato, 1884, or its suppression requested to ICZN. There is a possibility that *C. circinata* turns out to be a synonym of *C. gryphoides* Linnaeus, 1758, which should in this case take precedence over all those names.

Solen ensis major Chenu 1843 vs. *Ensis arcuatus* (Jeffreys, 1865) and *Ensis magnus* Schumacher, 1817

Names involved

Ensis magnus Schumacher, 1817, *Essai d'un nouveau système des habitations des vers testacés*: 143, pl. 14 fig. 1a, b.
Solen ensis major Chenu, 1843, *Illustrations conchyliologiques*, vol. 2: pl. 3 fig. 2, 2a, b, e.
Solen siliqua var. *arcuata* Jeffreys, 1865, *British Conchology*, vol. 3: 19.

The taxonomic recognition of *Ensis arcuatus* (Jeffreys, 1865) as a distinct species has come relatively late but is currently widely accepted. However the still earlier name *Ensis magnus* Schumacher, 1817, has been adopted as valid by COSEL (2009), with *E. arcuatus* treated as a synonym. The name *magnus* has been used repeatedly in the XX century (e.g. BLOOMER, 1905; NORDSIECK, 1969: 146; VAN URK, 1982: 30; SEAWARD, 1990: 83; POPPE & GOTO, 1993: 107) and is by no means "*oblitum*". *Ensis magnus* is the type species of *Ensis* Schumacher, 1817, by monotypy. HUBER (2010) proposed to declare *Solen ensis major* Chenu 1843 *nomen oblitum* in order to protect *Solen arcuatus* Jeffreys, 1865, but did not complete the action by providing the 25 instances of usage for *S. arcuatus*. We consider however this unnecessary, since *Ensis magnus* has precedence. In the event that *Ensis arcuatus* should be recognized as specifically distinct from *Ensis magnus*, the latter name remains valid because *Solen ensis major* would become a junior synonym of *Ensis magnus*.

Polititapes rhomboides (Pennant, 1777) vs. *Polititapes virgineus* (Linnaeus, 1767) (Figure 2, Table I)

Names involved:

Venus virginea Linnaeus, 1767, *Systema Naturae*, ed. 12: 1136.
Venus rhomboides Pennant, 1777: *British Zoology*, vol. 4: 97.

The name *Venus virginea* Linnaeus, 1767 was used for a common European species currently known as *Polititapes rhomboides* (Pennant, 1777), by most British authors in the XIX century as summarized in FORBES & HANLEY (1848: vol. 1, p. 388, pl. 25 fig. 4, 6) and JEFFREYS (1864, vol. 2, p. 353-355). Jeffreys explicitly wrote that this was *Tapes virgineus* "of modern authors", probably not of Linnaeus. Synonymy and reasons for preferring *rhomboides* for the European species were thoroughly discussed in BUCQUOY, DAUTZENBERG & DOLLFUS (1893: 397-400). Modern usage of *rhomboides* as the valid specific name was started by PETIT (1851: 297, in the binomen *Pullastra rhomboides*) but was triggered by the influential work of BUCQUOY, DAUTZENBERG & DOLLFUS and became universal after being adopted in WINCKWORTH's (1932: 244)

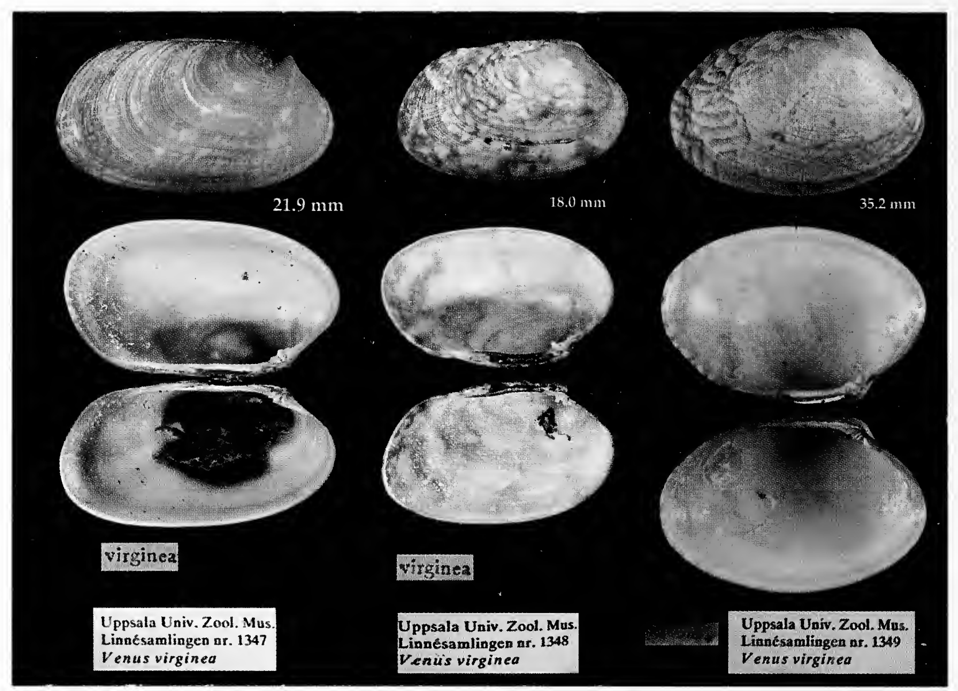


Figure 2. The Linnean types of *Venus virginea* in the Museum of Evolution, Uppsala. Specimen 1347 (actual length: 21.9 mm) and 1348 (actual length: 18.0 mm) are *Venerupis geographica* (Gmelin, 1791); Specimen 1349 is *Polititapes aureus* (Gmelin, 1791). The Swartz labels and the modern label are shown below each specimen. Photos courtesy of Erica Mejlon, the Evolution Museum, Uppsala.

Figura 2. Los tipos de Linneo de Venus virginea *en el Museo de la Evolución, Uppsala. Espécimen 1347 (longitud: 21,9 mm) y 1348 (longitud: 18,0 mm) son* Venerupis geographica *(Gmelin, 1791); Espécimen 1349 es* Polititapes aureus *(Gmelin, 1791). Las etiquetas de Swartz y la etiqueta moderna se muestran debajo de cada espécimen. Fotos cortesía de Erica Mejlon, el Museo de la Evolución, Uppsala.*

list of British molluscs. Type material of *Venus rhomboides* is stated as still existing by SMITH (1913).

The other taxon which has been denoted as *Venus virginea* Linnaeus, 1767 in the XIX century literature is currently known as *Marcia hiantina* (Lamarck, 1818) = *flammiculata* (Lamarck, 1818) = *rimularis* (Lamarck, 1818) = *vermiculosa* (Lamarck, 1818), and agrees with the type locality "in Indiis" stated by LINNAEUS (1767). The name *Venus virginea* was used in this sense by PHILIPPI (1849: vol. 3, p. 22 (28), pl. 8 figure 2-4), who was very critical over LAMARCK's (1818) taxonomic treatment of venerids but still distinguished *Venus hiantina* Lamarck, 1818 from *Venus virginea* Linnaeus, 1767 (Philippi stated "not of authors") = *rimularis* Lamarck, 1818 = *vermiculosa* Lamarck, 1818 = *flammiculata* Lamarck, 1818, all currently placed in synonymy of *Marcia hiantina.*

The interference with the European species seems to originate from the treatment of *Venus virginea* in GMELIN's (1791) edition of the *Systema Naturae,* where the description (p. 3294) is different from that of 1767 and a reference to CHEMNITZ (1784: vol 7, p. 60, pl. 43 Fig. 457-458) is added. The latter figures were published with the unavailable name *Venus edulis*, and Chemnitz wrote that the species is brought to the Viennese markets from Trieste and Fiume [now Rijeka, Croatia] in the Adriatic sea.

Table I. Number of hits for generic combinations of *Venerupis decussata, V. aurea* and *V. rhomboides* in Google Books (G.B.) and Google Scholar (G.S.), accessed May 20, 2013.
Tabla I. Número de resultados para las combinaciones genéricas de Venerupis decussata, V. aurea *y* V. rhomboides *en Google Books (G.B.) y Google Scholar (G.S.), consultado el 20 de mayo de 2013.*

	G.B.	G.S.		G.B.	G.S.
Ruditapes decussatus	3870	3450	*R. philippinarum*	5200	8780
Tapes decussatus	10300	1760	*T. philippinarum*	5950	4090
Venerupis decussata	2770	720	*V. philippinarum*	1210	780
Venerupis rhomboides	996	307	*V. aurea (aureus)*	1590 (264)	428 (74)
Polititapes rhomboides	5	0	*P. aureus*	65	12

The specimens on Figs. 457-458 are unquestionably European, but are more likely forms of *Polititapes aureus* (Gmelin, 1791). LAMARCK (1818: 600) wrote "Les fig. de Chemnitz que cite Gmelin, me paraissent étrangères à cette espèce". Anyway all this does not interfere nomenclaturally with Linnaeus' species: either Gmelin's usage is a misidentification, or if treated as a separate taxon it is a primary junior homonym.

There is a limited usage of *Tapes virgineus* in XX century as valid name for a European species (NEWTON, 1907; HARGREAVES, 1910; FORD, 1923; FISHER & TEMPLETON, 1935; MARRES, 1947), which precludes application of Art. 23.9. NORDSIECK (1969: 118) states in synonymy of *Tapes rhomboides*: "*Tapes virgineus* L., pars?" but does not use it.

DODGE (1952) stated an unmarked specimen of *Venus virginea* with no proven type status in the Linnean Society, London, which would agree with the specimen figured by REEVE (1864, pl. 4 sp. 17a) as *Tapes virginea*. Reeve's figure is clearly the same as *Venus rhomboides* Pennant, 1777 but, again, this has no bearing on the Linnean species. This shell is not currently registered as a type on the Linnean Society website <http://linnean-online.org>. Conversely there is a lot in University Museum, Uppsala (# 1347-1349) labelled as this species (WALLIN, 2001). These types are accompanied with the so-called 'Swartz labels", printed using the 12th edition of "Systema Naturae" as a model (WALLIN, 2001). We consider specimens 1347 and 1349 to belong to the species currently known as *Venerupis geographica* (Gmelin, 1791) and specimen 1349 to belong to the species currently known as *Polititapes aureus* (Gmelin, 1791). The latter resembles *Polititapes rhomboides* but is unequivocally distinguished by the much more narrow and less robust hinge plate, and the colour pattern with yellowish inside and brown streaks outside is more typical of *aureus* than of *rhomboides*.

From the preceding discussion we conclude that, would the name *Venus virginea* be revived, it should stand as a senior synonym of *Polititapes aureus* (Gmelin, 1791) or *Venerupis geographica* (Gmelin, 1791) if based on the extant types, and is not *Venus rhomboides* Pennant, 1777. Since both species (*Venus hiantina* and *V. rhomboides*) for which Linnaeus' name *Venus virginea* has actually been used have another accepted name with established usage, and since so much confusion surrounds the Linnean name, it is our intention to request suppression of the latter from the ICZN. In the meanwhile, we propose to continue the accustomed usage of the specific name *Polititapes rhomboides* (Pennant, 1777) as valid.

Polititapes rhomboides is a commercial species, albeit not of major importance, its marketing is regulated under this name in Spain and Portugal, and it is known under this name in legal texts regarding size and close season.

Another issue related to this name change is the generic placements for the European species of Tapetinae, particularly the option of ranking *Ruditapes* Chiamenti, 1900 (type species: *Venus decussata* Linnaeus, 1758, subsequent designation by DALL, 1902: 363) as a subgenus of *Venerupis* but *Polititapes* Chiamenti, 1900 (type species: *Venus aurea* Gmelin, 1791, subsequent designation by DALL, 1902: 363) as a genus. Without this being backed by a novel phylogenetic analysis of the Tapetinae, we feel it is preferable to follow a conservative usage, particularly for these names which apply to commercial species and are used by many non-taxonomists and also in legal documents. We can agree that *Tapes* (based on *Venus literata* Linnaeus, 1758) is not appropriate for the species considered here but the two most obvious options seem to be either to place all in *Venerupis* and rank *Polititapes* also as subgenus, or rank *Ruditapes* as full genus as well.

Cuspidaria striata var. *bicarinata* (Jeffreys, 1876) vs. *Cuspidaria bicarinata* (Jeffreys, 1882)

Names involved
Neaera striata var. *bicarinata* Jeffreys, 1876, *Annals and Magazine of Natural History*, (4) 18: 496.
Neaera bicarinata Jeffreys, 1882, *Proceedings of the Zoological Society of London* (1881): 939, pl. 71 fig. 1.

HUBER (2010: 792-793) declared *Neaera bicarinata* Jeffreys, 1882 a *nomen protectum* and *Neaera striata* var. *bicarinata* Jeffreys, 1876, a *nomen oblitum*. The species was not cited by ALLEN & MORGAN (1981), is merely listed in POUTIERS & BERNARD (1995), and has hardly ever been cited any more in the XX century literature, so that we are certain that the requirements of Art. 23.9.1 are not met. Anyway *Neaera bicarinata* Jeffreys, 1882 is not preoccupied. JEFFREYS (1876) mentioned a fragment of a species of *Neaera* from 'Valorous' sta. 13, described it and then wrote "It probably belongs to a species which I dredged in the 'Porcupine' Expedition of 1870, off the coast of Portugal, at depths of from 740 to 1095 fathoms, and which I propose to name *bicarinata*." The words "it probably belongs" exclude that described fragment from the type series of *Neaera bicarinata* (as of 1876) according to ICZN Art. 72.4.1, so that *bicarinata* remains a *nomen nudum* until its formal description in 1882. It is anyway the same name, with no connection whatsoever with *Neaera striata* (the previous species in the 1876 text) and the only issue is the date of availability, here retained as 1882.

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• Papers should conform the following layout:
First page. This must include a concise but informative title, with mention of family of higher taxon when appropriate, and its Spanish translation. It will be followed by all authors' names and surnames, their full address(es), an abstract (and its Spanish translation) not exceeding 200 words which summarizes not only contents but results and conclusions.
Following pages. These should content the rest of the paper, divided into sections under short headings. Whenever possible the text should be arranged as follows: Introduction, Material and methods, Results, Discussion, Conclusions, Acknowledgements and References. Unusual abbreviations used in the text must be grouped in one alphabetic sequence after the Material and methods section.
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• Footnotes and cross-references must be avoided. The International Codes of Zoological and Botanical Nomenclature must be strictly followed. The first mention in the text of any taxon must be followed by its authority including the year. In systematic papers, when synonyms of a taxon are given, they must be cited IN FULL, including the periodical, in an abbreviate form, where they were described, and the type localities in square brackets when known. Follow this example (please note the punctuation):
Dendrodoris limbata (Cuvier, 1804)
Synonyms
Doris limbata Cuvier, 1804, *Ann. Mus. Hist. Nat. Paris*, 4 (24): 468-469 [Type locality: Marseille].
Doris nigricans Otto, 1823, *Nov. Act. Ac. Caes. Leop.-Car.*, 10: 275.
These references must not be included in the Bibliography list, except if referred to elsewhere in the text. If a full list of references of the taxon is to be given immediately below it, the same layout should be followed (also excluding from the Bibliography list those which are not cited elsewhere).
Only Latin words and names of genera and species should be underlined once or be given in italics. No word must be written in UPPER CASE LETTERS. SI units are to be used, together with their appropriate symbols. In Spanish manuscripts, decimal numbers must be separated with a comma (,), NEVER with a point (.) or upper comma (').
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The references in the reference list should be in alphabetical order and include all the publications cited in the text but only these. ALL the authors of a paper must be included. These should be written in small letters or Small capitals. The references need not be cited when the author and date are given only as authority for a taxonomic name. Titles of periodicals must be given IN FULL, not abbreviated. For books, give the title, name of publisher, place of publication, indication of edition if not the first and total number of pages. Keep references to doctoral theses or any other unpublished documents to an absolute minimum. See the following examples (please note the punctuation):
Fretter V. and Graham A. 1962. *British Prosobranch Molluscs.* Ray Society, London, 765 pp.
Ponder W.F. 1988. The Truncatelloidean (= Rissoacean) radiation - a preliminary phylogeny. In Ponder W.F. (Ed.): Prosobranch Phylogeny. *Malacological Review*, suppl. 4: 129-166.
Ros J. 1976. Catálogo provisional de los Opistobranquios (Gastropoda: Euthyneura) de las costas ibéricas. *Miscelánea Zoológica*, 3 (5): 21-51.

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Figure 1. *Neodoris carvi*. A: animal crawling; B: rhinophore; C: gills.

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La Sociedad Española de Malacología

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